

NAME OF PROJECT:

Red River WWTP Exp & Rehab
NE WWTP Upgrade & Rehab Project

OPERATION AND MAINTENANCE MANUAL

ENGINEER:

Manchac Consulting Group Inc.
2137 Quail Run Dr., Baton Rouge, LA 70808
Phone: (225) 448-3972

CONTRACTOR:

Max Foote Construction Company
225 Antibes West
Mandeville, LA 70448
Phone: (985) 624.8569/Fax: (985) 624-8580

VOLUME 1 OF 1

(3) 120'-0" DIA. H40AHT TowBro® Clarifiers

Service Manuals

Siemens Industry Inc.
Water Technologies Business Unit
2607 N. Grandview Blvd., Suite 130 Telephone 262-547-0141
Waukesha, WI 53188 Facsimile 262-547-4120

Order No.2033/000140/44792

Customer P.O.

Installation

City of Bossier City
Red River WWTP Exp & Rehab
NE WWTP Upgrade & Rehab Project
Bossier City, LA

Mailing Address

Environmental Technical Sales, Inc.
7731 Office Park Blvd.
Baton Rouge, LA 70809
PH 225-295-1200
Attention: Ms. Kathryn Terito

Contractor

Max Foote Construction Company
225 Antibes West
Mandeville, LA 70448
Phone: (985) 624.8569/Fax: (985) 624-8580

Quantity: 4 hard 1 cd

Equipment

P.01:TowBro Clarifiers Specification Section 11340

Mailed

05/24/13

For Service and/or Parts Please Contact The Siemens Sales Rep. Below:

Ms. Kathryn Terito

Environmental Technical Sales, Inc.

7731 Office Park Blvd.

Baton Rouge, LA 70809

PH 225-295-1200

cc:

File

Project Manager: Robert Spuhler

Field Service

City of Bossier City
Red River WWTP Exp & Rehab
NE WWTP Upgrade & Rehab Project
Volume 1 OF 1
TowBro® Clarifiers
Spec. Section # 11340

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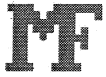
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Max Foote Construction Company, Inc.
225 Antibes West
Mandeville, LA 70448

985-624-8569 - Phone
985-624-8580 - Fax



Contract Number: 260-11431

Issue Date: July 19, 2012

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Purchase Order

maintenance and accessibility, durability of parts and shall comply with the applicable OSHA, state and local health and safety regulations.

9. Comply with all Equal Opportunity Regulations, Federal Safety Regulations and Contractor's Labor Agreement. The provisions of Executive Order 11246, as amended, Section 503 of the Rehabilitation Act of 1973, as amended, and the Vietnam Era Veteran's Readjustment Act of 1974, as amended, are hereby incorporated by reference.

10. Attachment "A" terms and conditions are part of this order.

SPECIAL SIEMENS TERMS AND CONDITIONS

Purchaser to be responsible for compliance with the following:

A. Assuming a bill of material and shipping notice is provided all shortages and patent or evident damages are to be noted on the delivery receipt, signed by the driver of the delivering carrier and faxed to Vendor within five (5) days from date of delivery to the jobsite.

B. Latent damage shall be reported in writing to Vendor within two (2) weeks from date of deliver to the jobsite. Also, all crating materials are to be retained an additional 2 weeks and made available with damaged goods upon demand for inspection by Vendor or representative of delivering carrier.

C. Photographs shall be made, whenever possible, of damaged equipment and crating materials for reporting purposes.

D. Failure to comply with the above criteria relieves Vendor of responsibility for damaged equipment in transit.

Vendor's warranty is for one(1) year and shall begin upon substantial completion of the project, acceptance by the Owner (5/1/2015) or as extended by contract time extensions and run concurrent with Purchaser's warranty. Under the warranty and under the agreement, Vendor will be liable for all direct costs to tangible property (such as energy cost penalty, removal, inspection, cost of return, warehousing or reinstallation) up to 100% of the purchase price.

Vendor will not be liable for consequential or incidental damages. Vendor warrants to Purchaser that the equipment shall materially conform to the contract documents and shall be free from defects in material and workmanship. Purchaser shall give Vendor prompt written notice of breach of this warranty. Vendor, Owner and Purchaser shall by mutual agreement determine if repair or replacement is feasible. Vendor's warranty is conditioned on Owner (a) operating and maintaining the equipment in accordance with the Vendor's expressed written instructions and (b) not making any unauthorized repairs or alternations.

Vendor's warranty does not cover damage caused by chemical action or abrasive material other than those reasonably foreseeable in the treatment plant flow-stream, misuse, or installation not in accordance with Vendor's written installation instructions. The warranties set forth herein are Vendor's sole and exclusive warranties and is subject to the limitation of liability as defined below. VENDOR MAKES NO OTHER WARRANTIES OF ANY KIND, EXPRESSED OR IMPLIED, INCLUDING WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY OR FITNESS.

PURPOSE, FUNCTION AND THEORY OF OPERATION OF TYPE H TOW-BRO® CLARIFIERS

The main function of a Tow-Bro Clarifier is to remove suspended matter from the water, through gravity settling, providing a clarified liquid overflow.

Sludge collection and concentration, along with removal, is accomplished by suction removal through the rotating Tow-Bro header. The computer designed Unitube header provides rapid, uniform removal of final clarifier flocculent sludge. The unique design assures effective results, simple operation and less maintenance requirements.

The effluent is drawn from the tank as it flows over adjustable V-notched weirs at the effluent channel located at the periphery of the tank.

DESIGN

The Unitube header is a rectangular-shaped arm of 1/4 inch plate steel for structural stability and hot-dipped galvanized after fabrication for corrosion resistance. The header is of tapered design with the cross section decreasing from the center of the tank (where the total sludge volume is the maximum) to the outer tip (where the total volume is least) for a uniform sludge withdrawal velocity. The constant velocities prevent the possibility of sludge build-up in the header or orifice clogging. The header is mounted at an angle of forty-five degrees to physically and hydraulically trap the sludge.

Activated sludge must be refluidized in order to transport it in the sludge conveyance device. A vane fluidizes the sludge into the area of influences of the orifices.

The peaked top prevents the sludge from collecting on the header and going anaerobic. As the header revolves, it cuts into the lower part of the sludge blanket, directing the sludge through the orifices with a minimum of agitation while assuring maximum solids pick-up.

The header is connected to a manifold at the center of the tank floor. The collected material passes through the manifold to the sludge draw-off pipe in the tank floor.

The Tow-Bro header manifold is attached to a center cage which is connected to the drive unit that is mounted on a center pier in the tank. As the drive rotates the center cage and manifold, the Tow-Bro header rotates around the tank floor collecting the settling solids.

A secondary function of the Tow-Bro Clarifier is the removal of floating matter (scum) which accumulates on the water surface. Scum removal is accomplished by full surface radial skimming to a scum collection trough.

Limiting Conditions

Effluent Flow	2.00 MGD (minimum)	6.00 MGD (maximum)
Returned Sludge Flow	2.00 MGD (minimum)	6.00 MGD (maximum)
Mixed Liquor Flow	4.00 MGD (minimum)	12.00 MGD (maximum)

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FOREWORD

This manual has been prepared to help meet the objectives of long machine life, cost-effective performance, high productivity and safety. This **manual must be read and thoroughly understood by those responsible for the installation, operation and maintenance of the equipment.** Siemens warranty does not cover damage caused by chemical action or abrasive material, misuse or improper installation. Non-recommended or unauthorized operating or maintenance procedures may result in personal injury, machine damage, downtime, lost production and voidance of any warranties. Sound operating procedures, safety requirements and recommended maintenance procedures are detailed both in distinct segments of this manual and wherever appropriate throughout the manual.

This GENERAL INFORMATION section contains information and instructions for Receiving, Servicing, Storing and Installing **Siemens** equipment. **General Safety Precautions** are included in this section.

If any special information is desired regarding the care and operation of equipment, **Siemens** will furnish it on request. Please include equipment identification and the order number in all correspondence so that the correct information can be provided. Requests for information should be directed to:

Siemens Industry, Inc.
Water Technologies Business Unit
2607 N. Grandview Blvd. Suite 130
Waukesha, WI 53188
Phone: (262) 547-0141

A detailed contact list is on the following page. To help us handle your request for assistance in the most efficient manner, please refer to the list.

The information, specifications and illustrations in this publication are based on the information in effect at the time of approval for printing. We reserve the right to make changes at any time.

*Siemens makes no warranty of any kind with regard to the material in this manual, including; but not limited to, implied warranties or fitness of **Siemens** equipment for a particular purpose. **Siemens** shall not be liable for errors contained herein or for incidental or consequential damages in connection with the performance or use of this material.*

SIEMENS CONTACT LIST

(Keep a copy of this page available for quick reference.)

CHECKING ON YOUR ORDER

To check on the shipping dates of your order or to report non-arrival of shipped components, or if your shipments are damaged, have parts missing or are unsatisfactory in some way, call:

Project Management Dept.
(262) 547-0141

CUSTOMER SERVICE

If you have a question about the assembly or operation of your equipment call:

Customer Service Dept.
(262) 521-8361, (262)-521-8462, (262)-521-8443 or (262) 547-0141

FIELD SERVICE

To schedule a service technician for check out of newly installed equipment or for factory repair service, call:

Field Service Dept.
Phone: (262) 521-8363 or (262) 547-0141
Ask for the Field Service Coordinator

PARTS

To obtain spare or replacement parts, call:

Parts Dept.
Phone: 1-(800) 931-1755

WEB SITE

You may also contact **Siemens** at our web site:

www.siemens.com/water

RECEIVING EQUIPMENT

After arriving at the site, the equipment should be inspected for damage sustained in transit. Damaged or missing parts are to be noted and reported to the carrier and to your **Siemens** Project Manager. This procedure will protect all parties until the responsibility for such damage or shortage is determined. Use of factory numbers for field identification are explained below:

IDENTIFYING EQUIPMENT AND PARTS

Siemens manufactured parts and subassemblies are marked (usually tagged) for shipment so that they can be easily identified and counted as they arrive at the job site. Where there is a large quantity of identical pieces, only a representative number of pieces in each bundle will be marked. At least one marked piece from each bundle should be kept to identify the remaining pieces. A number of documents are provided for these purposes. They are:

1. **Packing List** - Accompanies each shipment. Items for more than one unit and items in more than one crate may be listed. The final shipment of an order has a packing list marked "**COMPLETE**" or "**FINAL**". Parts listed, but not received, should be immediately reported to **Siemens** and identified with our Contract Order Number. Call 1- (262) 547-0141, **Project Management Department**.
2. **List of Materials** - This list itemizes all separately shipped piece parts and subassemblies. Each item shows the quantity required, the drawing number, the part or assembly number and a description corresponding to the drawing title. Each unit of an order will have a separate List of Materials, with the unit number shown at the upper right of the heading.
3. **General Arrangement Drawings** - Found in the back of the Service Manual. All items found on the "List of Materials" are in circles on the General Arrangement Drawings. Embedded items are not part of the "List of Materials". These are normally itemized and described in a "List of Components" block on the General Arrangement Drawings. These embedded items are not in circles on the drawings, but are enclosed with a hexagon. **Only final drawings, as furnished with this manual, are acceptable for use in field installation.** Approval drawings or drawings that do not have numbers in the circles are not to be used.
4. **Assembly Drawings** - Found in the back of the Service Manual. These are the drawings corresponding to the items shown on the "List of Materials" drawing. Assembly drawings serve as a parts list. As such, they should be retained by Plant Maintenance for reference when ordering spare or replacement parts and for important locating dimensions.

5. **Detail Drawings** - Found in the back of the Service Manual. Some items on the "List of Materials" are individual parts which can only be field assembled. Detail drawings of these piece parts are provided. Certain other detail drawings are provided which will aid in identifying parts of subassemblies.
6. **Field Bolt Connection Drawings** - Found in the back of the Service Manual. These drawings show hardware used in the assembly of the equipment and are used in conjunction with the Detail and Assembly Drawings. A review of these drawings should be made by the installer and a full check of items to make sure shortages are identified quickly and an understanding of the assembly process is understood.

Note that the rights to all drawings are reserved to **Siemens**. Drawings included with this manual may be used solely for installation, operation and maintenance of **Siemens** equipment.

GENERAL ARRANGEMENT DRAWING

Item numbers are shown encircled, followed by a description of the item. This encircled item number relates to the same item number on the List of Materials.

SERVICING EQUIPMENT

Maintenance requirements and recommendations are detailed in a specific section of this manual. **THERE IS NO SUBSTITUTE FOR PREVENTIVE MAINTENANCE.** A scheduled maintenance program must be planned and implemented. Effective maintenance will uncover problems before extensive damage and expensive down-time can occur.

A maintenance log, recording all maintenance performed, is an essential part of an effective maintenance program. A maintenance schedule, listing minimum required maintenance items and their performance intervals, is in the MAINTENANCE section of this manual.

Safety Hazard Warning Labels are affixed on **Siemens** equipment when a visual reminder is appropriate. The equipment owner is responsible for keeping these labels visible and in good condition. Replacement labels are available from our Parts Department.

If you have occasion to repair your equipment, **USE FACTORY PARTS.** Factory parts are designed for your equipment and will insure continued safe and efficient operation.

STORING EQUIPMENT

Once the equipment has been checked for any damage that might have occurred in transit, use the following guideline if the equipment must be stored. All equipment should be warehoused to protect it against inclement weather, dust or damage by vehicles. **Spare parts should also be warehoused until used.**

For items that have an expiration date or shelf-life such as adhesives, caulks and lubricants, refer to the storage instructions provided by the manufacturer. Prior to using these materials, recheck the expiration dates. If the products have expired, contact **Siemens** to purchase replacements.

For equipment not manufactured by **Siemens**, refer to the appropriate bulletin supplied at the back of this manual.

INDOOR STORAGE - SHAFTING, STRUCTURAL COMPONENTS, ETC.

Standard storage for fabricated steel components, shafting, etc. requires:

1. Dry area.
2. Adequate ventilation.
3. Space heaters available for heat and drying.
4. Adequate support under all equipment to prevent distortion and to raise equipment above any undesirable ground or floor conditions.
5. Tenting or tarpaulins, to protect from dust and dirt, well supported so as to provide ventilation.
6. Recoating with paint, primer or grease, of parts that may have been scratched or wiped clean of their protective coating in shipment.
7. Periodic checking to remove any accumulated condensation and rust and to recoat.

Painted surfaces are affected by long exposure to direct sunlight and should be shielded from same. Similarly, bitumastic coatings tend to become brittle and will chip. In general, exposure to direct sunlight and subsequent cooling is conducive to condensation of moisture and should be avoided. Check periodically for accumulations of moisture and/or surface rusting. If rusting is present, prepare the surface and recoat with proper material. Increase ventilation and reduce humidity.

INDOOR STORAGE - GEAR REDUCERS

Most manufacturers of this equipment interpret extended storage to mean more than four months. Although some items are shipped dry, generally their run-in oils contain additives which are rust proofing agents and the coatings remaining after draining will protect internal gearing for a four-month period under good warehousing conditions. In terms of extended storage, **unless the item is tagged to the contrary**, drain all sumps when received (to remove any condensation accumulated in shipping) and fill the sumps completely (except as noted below) with oil of the proper type and viscosity recommended in the manufacturer's manual or specified on the lubrication plate affixed to the reducer. This total filling will inhibit oxidation and corrosion of gears and bearings and reduce the possibility of condensate accumulation. Replace vents with plugs if sumps are completely filled.

NOTE: Some gear reducers have a permanent vent in the reducer body which should, after filling the sump with oil, be plugged to prevent leakage. A round wooden toothpick is suitable for this purpose.

Finally, tag the reducer to indicate that, just prior to installation, the oil must be drained to operating level and vents re-opened or re-installed. Viscosity of the oil should be noted on the tag.

INDOOR STORAGE OF ELECTRICAL APPARATUS AND MOTORS

Assuming the proper warehouse control of ventilation, etc., as described before, block open control panel covers or doors so air can circulate. Shield apparatus from direct sunlight. Small apparatus can be stored in the original containers (if received dry).

ELECTRIC MOTORS: A.C.

Motors, if not mounted, store in the original containers in a clean, dry protected warehouse under the following conditions:

1. The storage area is to be free from vibration and from extremes in temperature.
2. The motors are to be fully greased at the time of going into extended storage.
3. Shafts on all motors must be rotated manually at least one full turn at least once every 6 months, and additional grease added, purging some of that in the cavity.
4. All drains must be fully operable while in storage and/or the drain plugs removed. The motors must be stored so that the drain is at the lowest point. All breathers and automatic "T" drains must be operable to allow breathing at points other than through the bearing fits. Vertical motors should be stored in the vertical position.

GENERAL INFORMATION

5. All units equipped with heaters are to have the heaters connected if storage conditions in any way simulate or approach operational conditions.
6. Windings are to be checked for resistance with a megohm meter at the time equipment is put in storage. At termination of storage, this check should be repeated prior to applying power. The minimum readings should be 1 megohm for motors rated 600 volts and less. Any drop below this point indicates the need for electrical or mechanical drying. When a large quantity of motors is stored, an inspection or sampling should be made by removing the end brackets and visually inspecting for the presence of water in the grease or rust on the bearing. If water or rust is present, replace the bearings and relubricate.
7. Grease in the motors is to be purged at the time of removal from storage, being replaced with an ample supply of fresh grease in each grease cavity.
8. Corrosion resistant coating should be applied to external motor parts when the probability of corrosion exists.
9. Where motors are not in the original containers, but are removed and mounted on the other pieces of machinery, the mounting must be such that the drains and breathers are fully operable. The drains must be kept at the lowest point on the motor and/or the drain plugs removed so that all condensation can automatically drain out. Vertical motors should be stored in the vertical position.
10. All other storage conditions apply, including rotation of motor shafts. Where such conditions cannot be met, the equipment must be treated the same as if it were mounted in its normal position and all protective devices such as heaters, breathers and drains fully operable.

OUTDOOR STORAGE - GENERAL PRECAUTIONS

If warehousing is not possible, a proper site must be chosen, with attention paid to drainage, ventilation and area size, so that space is provided for air circulation and access by inspecting personnel. It is necessary to shield the materials from direct sunlight, rain, snow, dust, etc., with tenting, if possible, or well supported tarpaulins as a minimum. Space heaters should be available for heating and drying in cold or wet weather. Block **all** material off the ground a minimum of 6" (152 mm) higher than any expected level of rain, snow, etc. Adequate support of all fabricated steelwork is essential to prevent warping.

OUTDOOR STORAGE - STRUCTURAL COMPONENTS, SHAFTING, ETC.

Periodic checks, with a frequency dependent on the climate, must be made to locate rusting surfaces and accumulations of condensation. If rust is evident on painted surfaces, remove rust, reprime and repaint. If surface was originally grease coated, remove rust and recoat with waterproof grease. As long as good cover is provided, block open inspection doors, etc., slightly to increase ventilation in housings.

OUTDOOR STORAGE OF GEAR REDUCERS

In addition to the precautions taken for indoor storage and general outdoor storage (above) provide for additional ventilation under proper tarpaulin cover. Drain oil sumps at six-month (seasonal change) intervals so that oil of proper viscosity is in the sump. Check more often for surface rusting and recoat if rust is found.

OUTDOOR STORAGE OF ELECTRICAL APPARATUS (EXCEPT MOTORS)

Using proper tent or tarpaulin coverage, take all the precautions for indoor storage, and the general precautions above plus provide additional ventilation (and heat under winter conditions). All cartons are to be opened and sealing films to be removed unless the carton specifically states otherwise. Moisture absorbing materials may be found in some cartons. These should be removed. Plastic shock absorbing particles, which surround some small items, should be removed. Inspect more often for surface rusting and recoat if rust is found. Do not store electrical components directly on the ground.

OUTDOOR STORAGE OF ELECTRIC MOTORS

The following are considered by motor manufacturers to be the minimum precautions for outdoor storage of electric motors:

1. Coat all machined parts with **Cosmolyne or similar material if not already protected. Motors should be elevated a minimum of 6" (152 mm) above the ground.**
2. Remove plastic covering (or carton) and cover motors with a tarpaulin. This will offer protection from the weather while allowing the motor to breathe.
3. Keep the motors warm. If equipped with space heaters, energize at all times. If space heaters were not supplied, auxiliary heat must be used to keep the motor windings warm and free of condensation.
4. Motors with grease lubricated bearings have inherent rust inhibitors in the grease. The shaft should be rotated slowly by hand 1-1/3 revolutions at least once every 60 days. This will distribute the grease in the bearings.

5. Motors with oil lubricated bearings should have the oil reservoir filled with a good grade of rust inhibiting oil. The shaft should be rotated slowly by hand at least every 30 days to keep the bearings lubricated.
6. At termination of storage, the motor should be checked for resistance with a megohm meter prior to applying power. The minimum readings should be 1 megohm for motors rated at 600 volts and less. Any drop below this point indicates a need for electrical or mechanical drying.

STORAGE OF NON-METALLIC COMPONENTS - GENERAL PRECAUTIONS

1. Store components in a cool place. High temperatures may cause part distortion or softening and creep.
2. Store components out of direct sunlight as some materials are sensitive to ultraviolet light.
3. Provide adequate support under all items to prevent distortion and to keep them off the ground.
4. Some non-metallic items may creep under load; do not stack heavy objects on non-metallic parts.
5. These materials are flammable; **always protect from heat and flame.**

INSTALLING EQUIPMENT

Before installing this equipment, study the INSTALLATION section of this manual carefully - proper installation will minimize operating problems and provide better performance. Those experienced in the installation of **Siemens** equipment, as well as those less experienced, will benefit by thorough study of all material presented here.

In preparing this manual, particularly for the less experienced, many details not ordinarily found in a manufacturer's manual of this kind have been included. Procedures outlined in this manual represent a simple, effective and accepted method of installing **Siemens** equipment. Based on installation experience, other procedures may provide comparable results. However, regardless of what method is employed, if a discrepancy is noted between the manual and the erection drawings, the **DRAWINGS ALWAYS TAKE PRECEDENCE.**

GENERAL EQUIPMENT PRECAUTIONS

STANDARD ERECTING PRACTICES

Fabricated steel equipment, as manufactured by **Siemens**, should pose no unusual problems in erection. A reasonable amount of fit-up and adaptation (as defined by the AISC "Code of Standard Practice for Steel Buildings and Bridges", ASSC 303 Section 7.14.) should be considered part of erection.

However, if a problem is traceable to equipment manufactured by **Siemens**, back-charges for correcting it will require prior written approval of an authorized **Siemens** representative. Complete cost documentation for field labor and materials is required. Profit, overhead and all other charges are not allowed.

COLD WEATHER ENVIRONMENT

During operation **Siemens** equipment transports and treats water and wastewater. Be alert to the hazards involved when unexpected freezing conditions occur. When freezing temperatures are encountered, ice may form, creating conditions which may damage equipment and interfere with treatment. Where freezing temperatures are expected, equipment and systems should be protected as appropriate to meet such conditions. Contact **Siemens** Customer Service if equipment specific questions related to cold weather operation arise.

Normally, equipment should operate the same during the winter as it does in other seasons. When ambient temperature falls below freezing, it is necessary that flow to the unit is continuous.

NOTE: **SIEMENS ASSUMES NO RESPONSIBILITY FOR DAMAGE TO EQUIPMENT WHICH IS SUBJECT TO COLD WEATHER CONDITIONS. ONLY PLANT OPERATORS ARE IN A POSITION TO DETERMINE THE DEGREE OF EQUIPMENT PROTECTION REQUIRED TO PREVENT DAMAGE.**

PAINTING

Applications of finish paint should be done with care. Vents, seals, gaskets, etc., should be masked off to avoid plugging and damage due to paint build-up. After paint has been applied, all equipment should be inspected to see that vents have not become plugged and that parts that are to have relative movement have not become painted tight. Especially check that the torque limiting devices on drives (if supplied) have not been glued together by paint. Seals and gaskets should be inspected to see that they have not become so stiff from paint build-up that they do not seal. Warranty charges resulting from inappropriately applied paint will not be accepted.

STAINLESS STEEL BOLTS

Where stainless steel bolts and nuts are used in the installation of our equipment, the bolt threads should be coated with an anti-seize compound such as "Never-Seez" or an equivalent. This will reduce the possibility of galling or seizing. Renew this coating if repairs require disassembly.

DRIVES

Do not operate any drive unit if its torque overload device is not functioning properly.

Do not allow excess slack to build up in a drive chain or tighten it to the point that the links cannot flex.

Be alert to changes in the sound of the operating drives. Unusual noises should be investigated.

Hand contact is not an acceptable method of detecting an overheated motor. Provide for overload protection in the starter.

GENERAL SAFETY PRECAUTIONS

Safety precautions related to installing, operating and maintaining **Siemens** equipment are detailed both in distinct segments of this manual and wherever specifically appropriate. Look for the captions: CAUTION, WARNING and DANGER. Their selection is based on the likely consequence of human interaction with a hazard in terms of:

1. The degree of severity (minor injury, severe injury, death).
2. The probability of severity (WILL result in, COULD result in). Definitions for identifying hazard levels are provided below:
 - DANGER:** Immediate hazards which WILL result in severe personal injury or death.
 - WARNING:** Hazards or unsafe practices which COULD result in severe personal injury or death.
 - CAUTION:** Hazards or unsafe practices which COULD result in minor personal injury or product or property damage.

A pictorial illustrating the nature and/or possible results of the hazardous act accompanies the hazard warning.

Follow the safety recommendations in this manual. YOU are the key to safety. Good safety practices not only protect the personnel around you, they are your own best protection. Conforming to good safety practice in areas of installation, operation and maintenance is the **responsibility of the equipment user**.

First-aid equipment must be available in all areas. This equipment must consist of items needed to treat most common injuries and the items required by the Material Safety Data Sheets (MSDS's) for the hazardous chemicals and materials used by your system. Make sure you have the appropriate material safety data sheets on file.

Safety Hazard Warning Labels are affixed on **Siemens** equipment when a visual reminder is appropriate. The equipment owner is responsible for keeping these labels visible and in good condition. Replacement labels are available from our Parts Department.

Safety is a function of procedures, maintenance and management. It is the responsibility of all personnel. All must be committed to accident avoidance and safe operation. Read and be thoroughly familiar with the manual and all additional publications supplied. The use of common sense and good judgment, guided by the safety recommendations in the manual, will minimize potential injury and equipment damage. The safety hazards listed on the next pages may be encountered in installing, operating or maintaining **Siemens** equipment. The accompanying safety recommendations are general in nature. Specific recommendations are presented in the individual equipment manuals.

POWER SOURCE LOCK-OUT



Failure to lock out all sources of power while maintaining or adjusting equipment may result in serious personal injury. Following are the steps of a typical lock-out procedure:

1. Alert the operator and supervisor.
2. Identify all sources of residual energy.
3. Before starting work, place padlocks on the switch, lever or valve, locking it in the "off" position, installing tags at such locations to indicate maintenance in progress.
4. Insure that all power sources are off and bleed off hydraulic or pneumatic pressure or "bleed off" any electrical current (capacitance) as required, so machine components will not accidentally move.
5. Test operator controls.
6. After work is completed, all machine safeguards that were removed should be replaced, secured and checked to be sure that they are functioning properly.

7. Only after ascertaining that the machine is ready to perform safely should padlocks be removed and the machine cleared for operation.

(From concepts and Techniques of Machine Safeguarding 1980; U.S. Dept. of Labor OSHA.)

ELECTRIC TOOLS AND DEVICES USING ELECTRIC CORD CONNECTIONS



It is recommended that cordless tools be used.

Read and follow the tool and/or other electrical device manufacturer's safety warnings.

There is a risk of electric shock and possible death when using power tools supplied by electric cords. **Keep these tools and all other electric devices away from liquid.** There are electrically live parts in most tools and other electric devices even when the switch is off. **Any**

liquid touching an electric tool or device is electrified and can cause an electrocution. If an electric tool or device that is connected to an electrical power source contacts liquid, **disconnect the electrical power source immediately.** Do not attempt to unplug the tool or device. **Do not touch or reach into the liquid or touch tools or other devices that are in contact with liquid.**

CONFINED SPACE ENTRY/VENTILATION



Treatment plants often have confined spaces with limited access, such as tanks or wells (closed or open), sewers, tunnels, closed rooms, etc. Explosive or toxic gases can be evolved from biological activity and can collect in these confined areas. Toxic gases include hydrogen sulfide and carbon monoxide. **Hydrogen sulfide** has a strong "rotten eggs" odor; however, this gas will desensitize the sense of smell quickly and give the impression it has dissipated. Breathing air that contains over 500 ppm of hydrogen sulfide can cause serious illness

or death in a few minutes. **Carbon monoxide** is an odorless, tasteless gas that can cause unconsciousness with little or no warning and serious illness or death from prolonged exposure. An oxygen deficiency can develop in confined areas even after an area has been purged of toxic gases.

The oxygen level must be over 19.5% to provide acceptable working conditions.

Means of ventilating the confined spaces should be provided when work is to be performed in them. Ventilation is also required when using volatile or toxic solvents in cleaning or painting operations and when welding in confined spaces. When it is necessary to enter a confined space where toxic gases may be present, a methane/hydrogen sulfide/oxygen detector should be used to determine air quality before entering. Personnel in the confined space should be protected by breathing equipment, methane/

hydrogen sulfide detectors and safety harness. Follow the confined space entry procedure written for your facility. See your facility Health, Safety and Environment supervisor for this information.

EXPLOSION



Combustible methane gas is often generated in treatment plants. Production of methane may be part of the treatment process or methane may be generated by the natural decomposition of organic material. The potential for an explosion or fire is always present when methane becomes mixed with air and comes in contact with a flame or spark. Gas that is contaminated with air should never be sent to a flame source, but should be wasted to the outside atmosphere.

No smoking, open flames or welding should be permitted in or near any area where methane may be present.

FIRE HAZARDS



The use of welding equipment and cutting torches may be required in the erection and maintenance of the equipment. Combustible, non-metallic materials may be used as equipment components. Metallic equipment may be coated with combustible substances. Volatile solvents may be in use. The possibility of a fire is always present. A fire can grow quickly, sometimes emitting toxic gases.

Move combustible materials away from areas where there may be heat or open flame. Fire extinguishers and plant water must be available in the work area. Workmen must be able to leave the work area from multiple locations. Avoid breathing fumes if a fire occurs.

HANDLING HEAVY EQUIPMENT



The equipment often has large and heavy components, which must be lifted and located during installation. Loss of control during handling may result in personal injury or equipment damage. Cranes, hoists and other lifting gear must have a load capacity greater than the loads to be lifted. Lifting points should be selected with care and lifting harness should be stabilized. **Avoid hand lifting of heavy parts.**

HOUSEKEEPING



The equipment is often located where liquids and sludge can wet equipment, floors and other surfaces, creating a potential for slipping and falling. Some equipment may be exposed to the weather and become wet and/or ice coated. Use care when working in such areas. Clean up spills of water, sludge, oil, etc., as soon as they occur. Practice good housekeeping.

BIOLOGICAL HAZARD



If this equipment is being used in conjunction with a biological treatment system, care should be taken to avoid direct contact with the water and sludges. Appropriate personal protective equipment and good hygiene practices should be used to prevent viral and bacterial infections.

Hands should be washed frequently working around the equipment. Gauze-type respirators should be used where aerosols or mists are present and cuts and scrapes should be kept clean and covered when working around the equipment. Gauze-type respirators should be used where aerosols or mists are present.

Personnel should be aware of and observe all local safety codes and OSHA regulations. The safety precautions recommended in this manual do not replace these codes and regulations.

EXTRA COPIES OF THIS MANUAL

Extra copies of this manual may be obtained from **Siemens**. However, as our manuals and contract drawings are archived, the cost of retrieval will increase the price of duplication. For extra manuals, please contact the **Parts Department at 1-(800) 931-1755**.

VIDEOTAPING

Siemens does not permit or authorize videotaping of its service personnel as they are providing instruction for the operation and maintenance of **Siemens** equipment, unless approval has been obtained for the videotaping session in advance. For permission, please call **(262) 521-8457** or **(262) 547-0141** and ask for the **Manager of Field Services**. Or contact **Siemens, 2607 N. Grandview Blvd. Suite 130, Waukesha, WI 53188**.

Completion of a standard agreement form will be required.

In the event that a customer or customer's representative videotapes **Siemens** service personnel during start-up and/or field service, it is expressly agreed that the accuracy and completeness of such videotape is the sole responsibility of the customer and that **Siemens** will not be liable for any loss, injury, cost or damage arising from or in connection with such videotape.

**TOW-BRO[®] CLARIFIER
H-DRIVE**

MANUAL 44792-01

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TOW-BRO® CLARIFIER, H-DRIVE

The instructions and recommendations in this manual are intended to assist the Erecting Contractor, the Plant Operator and Maintenance Personnel.

Because plant design varies according to Engineer's specifications, State and Local codes and Insurance and Underwriters' requirements, the instructions are necessarily general in nature. If more specific information is required or if questions of a technical nature arise, please contact your local **Siemens** representative or the factory. (See the GENERAL INFORMATION section.)

Recommendations on the storage of this equipment are included in the GENERAL INFORMATION section of this manual.

All drawings submitted are to be found in the manual pocket. These include General Arrangement Drawings specifically for erection.

SAFETY PRECAUTIONS

General Safety Precautions to be used in erecting, operating and maintaining this equipment are included in the GENERAL INFORMATION section of this manual. Precautions that are specific to Circular Clarifiers are included within the text of this manual. A caption of CAUTION, WARNING or DANGER indicates the severity of the hazard and a graphic symbol indicates the nature of the hazard. Recommended precautions are included in the text, adjacent to the symbol.

The primary hazards associated with installing circular sludge clarification equipment are identified below.

HANDLING HEAVY EQUIPMENT



Circular clarifiers have large and heavy parts, which must be lifted and located during assembly.

Cranes, hoists and lifting gear must have a load capacity greater than the loads to be lifted. Lifting points should be selected with care and lifting harness should be stabilized. **Avoid hand lifting of heavy parts.**

PERSONNEL PROCEDURES

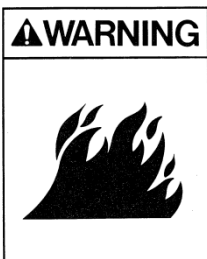


Installation procedures will require working in elevated positions. Secure ladders before use. Safety harness should be worn when there is danger of falling. **Do not use bridge without handrails in place. Do not work outside of the handrails.**



The access area for drive maintenance is below the bridge deck level. The difference in level will depend on the bridge design. A falling hazard exists. Use caution when in or near the access area.

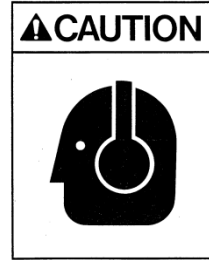
FIRE HAZARDS



The use of welding equipment and cutting torches may be required in the erection of Circular Collectors. Some components may be made from polymeric materials. These materials are combustible. Metallic equipment is frequently coated with combustible substances. A fire can grow quickly, sometimes emitting toxic gases. Move combustible materials away from an area in which welding or cutting is being done. **Keep combustible materials away from heat and open flame. If a fire occurs, do not breathe fumes.**

Fire extinguishers and plant water must be available in the area. Workmen must be able to leave the tank quickly.

WELDING HEALTH HAZARDS



Since **Siemens** does not know what welding processes and filler materials will be used for field welding, the following general welding health hazard data should be conveyed to welding personnel.

Arc rays can injure eyes and burn skin. **Heat rays** (infrared radiation from flame or hot metal) can injure eyes.

Overexposure to electric arc welding or oxy-fuel gas processes may create one or more of the following hazards. **Carbon Steels** - Excessive inhalation of metallic fumes and dusts may result in irritation of eyes, nose and throat. **Stainless Steels** -Cancer hazard (contains chromium and nickel). Excessive inhalation of metallic fumes and dusts may cause sensitization dermatitis, inflammation and/or ulceration of the upper respiratory tract and possible cancer of nasal passages and lungs.

Electric shock can cause injury or death.

Noise can damage hearing.

Read and understand the welding materials manufacturer's instructions and precautionary label on the product being used. For further health hazard details, consult the welding materials manufacturer's Material Safety Data Sheets.

GUARDS



Guards cover several points on Circular Clarifiers to prevent personal injury from moving parts. If guards are not in place during installation procedures, use caution when operating equipment and put guards in place when these procedures are complete.

STANDARD ERECTING PRACTICES

SIEMENS FABRICATED STEEL EQUIPMENT

Fabricated steel equipment manufactured by **Siemens** should pose no unusual erecting problems. Due to the nature of such equipment and the condition of the containing structure (over which we have no control), a reasonable amount of fitup and adaptation is considered standard erection practice. The use of tools, such as "come-alongs", welding and cutting torches, drift pins and reamers, is to be expected.

When new units are tied into existing units, a major amount of fit-up may be required. Accumulated tolerances in the existing equipment usually require detail fit-up for tie-in and alignment.

Standard erecting practice, as defined by the AISC "Code of Standard Practice (3/05)," Section 7.14., specifically states that:

“The correction of minor misfits by moderate amounts of reaming, grinding, welding or cutting, and the drawing of elements into line with drift pins, shall be considered to be normal erection operations. Errors that cannot be corrected using the foregoing means, or that require major changes in member or connection configuration, shall be promptly reported to the Owner’s designated representatives for design and construction and the Fabricator by the Erector, to enable the responsible entity to either correct the error or approve the most efficient and economical method of correction to be used by others.”

If a problem is traceable to fabrication or engineering, backcharges for replacing or correcting materials require prior written approval of an authorized **Siemens** representative and will only be considered with prompt, complete cost documentation based on standard, direct field labor hours and material. Profit, overhead and all other charges will not be allowed. Payment may be refused for corrective work that is done without the above-mentioned approval and documentation.

FASTENER INSTALLATION

It is important to install fasteners so that they adequately connect the parts they are to join without loosening and without causing damage to the parts in the joint. In joints where there is a possibility of fatigue, or where a connection has been designed as slip-critical, proper pretension of the fastener must be provided.

Siemens equipment is manufactured from traditional materials (metals) as well as materials that are on the leading edge of technology. Using the following instructions for fastener tightening will insure that your equipment is properly installed.

METAL TO METAL CONTACT

Siemens uses common bolts and screws in the majority of joints where all plies in the joint are metal. Common fasteners are made from materials such as ASTM A307 steel and SAE grade 2 steel. In applications where corrosion is a concern, fasteners made from 300 series stainless steel are used. For these joints, the fasteners can be installed in the “snug-tightened” condition. From the Specification for Structural Joints Using ASTM A325 or A490 Bolts (June 23, 2000): “The snug-tightened condition is the tightness that is attained with a few impacts of an impact wrench or the full effort of an ironworker using an ordinary spud wrench to bring the connected plies into firm contact.”

Unless a connection is made up with High strength bolts (A325, A490 or SAE grade 5 or grade 8) no pre-load is required.

For joints made up with high strength fasteners, the Research Council on Structural Connections (RCSC) of the American Institute of Steel Construction (AISC) recognizes three types of joints, snug-tight, pre-tensioned, and slip-critical. If a joint was designed as slip-critical, or requiring pre-tension, it will be indicated as so on the drawings. Use the procedures found in Section 8 of the Specification for Structural Joints Using ASTM A325 or A490 Bolts (2000, Research Council on Structural Connections c/o AISC) to properly preload the fasteners in the joint if preload is required.

NON-METAL CONTACT

For joints that involve one or more items that are not made from metal, there may be special instructions for the tightening of fasteners. Carefully read the instructions in the Operation and Maintenance Manual and the notes on the drawings where non-metal parts are used. There may be special fastener torque tables or other notes about making up the connection.

If the fasteners in a connection that involves a non-metal part are over torqued, there is the likelihood that the non-metal parts will be deformed or put into a failure mode. Because of the tendency of non-metal parts to exhibit high rates of material creep under load, there may also be requirements for retightening the fasteners after a period of time. Follow their instructions carefully.

If there are no specific instructions for tightening a fastener in a joint that has one or more non-metal parts, then it is sufficient to tighten the fastener until the parts are in complete contact, the fastener is tight and there is no deformation of the parts or of any washers that are included.

ANCHORS

Siemens supplies many types of concrete anchors with our equipment. When a proprietary anchor is provided, whether it is adhesive style, wedge style or other, follow the anchor manufacturer's instructions to torque the nuts or bolts used with these anchors.

ERECTOR'S CHECKLIST

If your contract includes a factory pre-grout check by a **Siemens** field service technician, the following should be completed before arranging the first site visit:

1. Install and plumb the center pier.
2. Grout in the center pier.
3. Install the entire mechanism including the bridge, handrail and grating or floor plate per these manual's instructions.
4. **DO NOT** grout under the drive at this time.
5. **DO NOT** operate the drive under power. This will damage the drive since there is NO oil in either the worm gear or the spur gear housings. The protective overloads are not set at the factory. They will be set by the technician.
6. A surveying level will be required for the technician to check the horizontal plane of rotation.

The technician will check the equipment installation on the pre-grout trip. After the equipment has been checked, the drive should be grouted.

A final mechanical start-up trip will be made by the **Siemens** technician. Prior to this trip, permanent power will be required along with connections made to the torque overload switches. It is MANDATORY that the overloads be in service at this time. If a torque test is to be performed, the tank needs to be cleared of all debris. A witness will be needed for the test. If required, the equipment will be certified by the Field Service Manager after the technician's report has been submitted.

Operation and maintenance instructions will also be provided at this time.

FIELD BOLTS

Clarifiers utilize a hardware kit that contains the usual and customary hardware for a standard mechanism. Please note that some of the connections supplied in this kit may not be required on the furnished mechanism. The kit also contains hardware unique to the furnished mechanism. This kit is ordered from the Field Connection Drawings, located in this manual. The kit can be furnished from several different suppliers and can arrive at the job site in multiple shipments, usually at a different time than the equipment. The contractor should be aware of this and set aside a safe storage area for the hardware until it is required for erection.

SITE PREPARATION

Before actual erection of equipment has begun, a thorough inspection of the site is necessary. **Siemens** assumes no responsibility for site preparation. We recommend that the site be cleared of all excess material to allow for safe and easy movement of the erection crew and their equipment. All foundation anchor bolts and other steel work embedded in concrete must be checked for cleanliness and accuracy of location. Continual referral to General Assembly Drawings and/or Anchor Bolt Layout Drawings will insure accuracy when equipment is erected. In the event of an error in location of the steel work or anchor bolts, they must be correctly positioned by the party(s) responsible before erection has begun.

If stainless steel bolts and nuts are used in the installation of the equipment, the bolt threads should be coated with a non-seizing compound such as "Never-Seez" or an equivalent.

SETTING OF ANCHOR BOLTS - REFER TO *Figure 1*

When constructing the tank, it will be necessary to locate and set the combination anchor bolt template and grout shield **1** **exactly** in the center of the tank and oriented properly with the centerline of the bridge. Set the anchor bolts as shown on the General Arrangement Drawings. This template locates the anchor bolts **3** for the center pier. Note that the lower jam nuts **5** are used for setting the template at the design elevation. Secure the template with another jam nut **5**. Allow sufficient thread to plumb and grout the center pier at a later time.

SETTING OF MANIFOLD BOTTOM SEALING RING

NOTE: THE BOTTOM SEALING RING IS SHIPPED WITH THE MECHANISM AND MUST BE THE NEXT ITEM INSTALLED.

Locate and set the bottom sealing ring exactly in the center of the tank in relation to the center pier anchor bolt template and grout shield **1** and oriented properly with the centerline of the sludge pit. Drill and install the anchor studs **6** as shown on the General Arrangement Drawing. The lower jam nuts are used for setting the bottom sealing ring at the design elevation. The bottom sealing ring must be set level. Secure the bottom sealing ring with plain washers **8** and hex nuts **7** on the anchor bolts.

CENTER PIER INSTALLATION

After the concrete around anchor bolts has cured, run a full hex leveling nut **4** and cut washer **2** down on each bolt of the center pier anchor bolts. Adjust the level of these washers and nuts to the design elevation of the center pier bottom flange, within +/- 1/16" (1.5 mm).

Although the anchor bolts are now ready to receive the center pier, some comparative measurements will have to be made to determine which components must enter tank first, the center pier or the center cage assembly. Generally, the center pier will be placed first; occasionally the top of the center pier will be too wide for the manifold or cage to be dropped over it.

REFER TO THE GENERAL ARRANGMENT DRAWINGS FOR SPECIAL SEQUENCE OF INSTALLATION OR SPECIAL INSTRUCTIONS, IF REQUIRED, FOR THE CENTER PIER, MANIFOLD AND CENTER CAGE.

NOTE: H30 and H30A units require the center pier to be set per the detail on the General Arrangement Drawings (the top drive mountings are unsymmetrical).

PLUMBING THE CENTER PIER

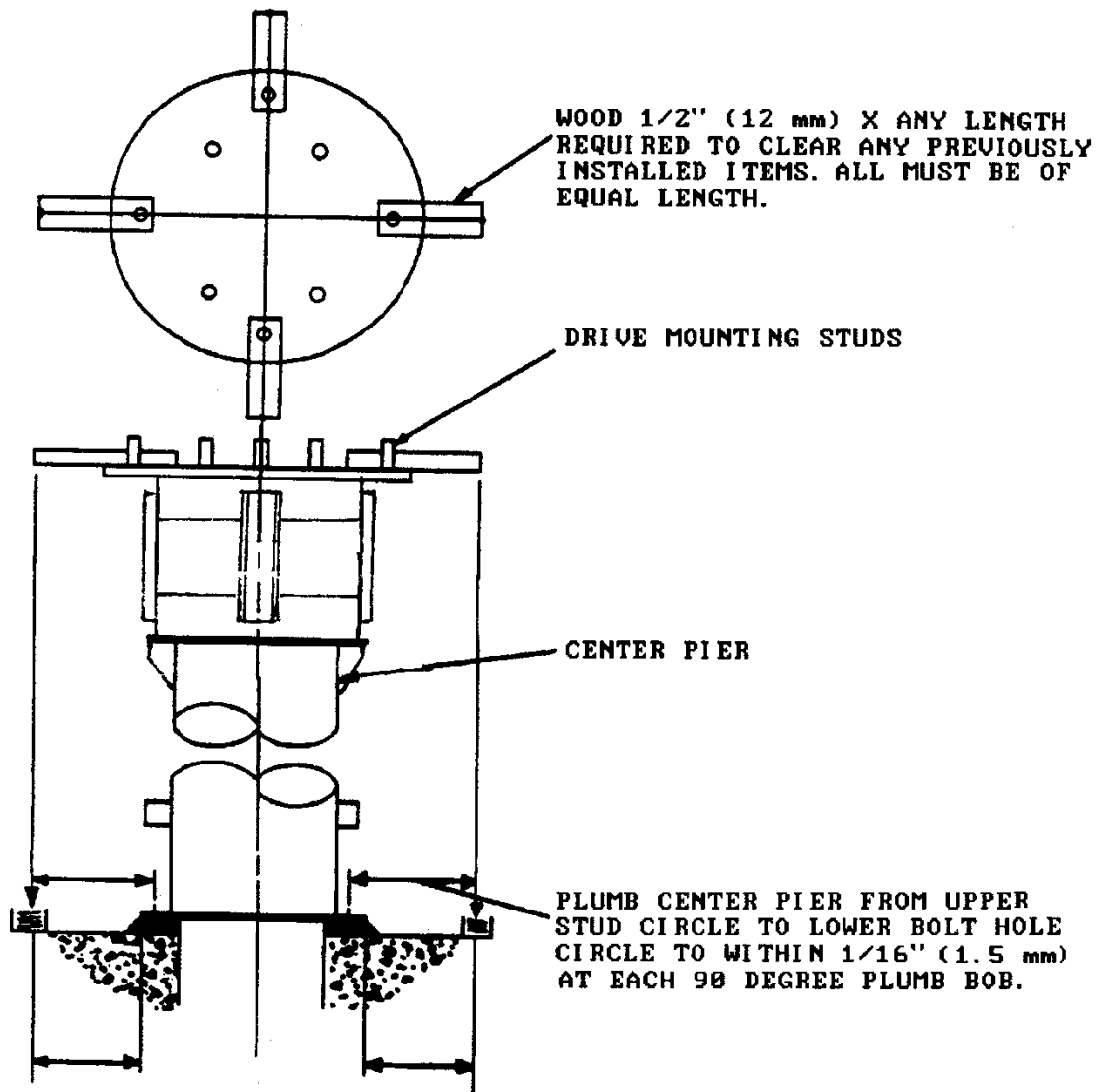
Important Note: If the center pier is not plumb to within 1/16 inch (1.5mm), the remainder of the rotating equipment and the drive will not function optimally. **Double check the pier for plumbness before placing the grout under the base flange.**

Drop four (4) plumb lines 90° apart and of equal distance from the top studs of the center pier. (See *Figure 2*). Let the plumb bobs hang in a can of water or oil to stabilize them. Measure in from each plumb line to the lower flange bolt holes. Adjust the leveling nuts under the pier until two measurements 180° apart from each other are the same to within 1/16" (1.5 mm). Then adjust the leveling nuts so the measurements are equal for the two remaining plumb lines. Tighten down the hold-down nuts per the Fastener Installation Instructions.

Adjust the bottom sealing ring for concentricity with the pier at this time. Measure from the four (4) plumb lines to the sealing ring. Measurements should be equal within 1/16" (1.5 mm). If any adjustment is necessary, re-level the sealing ring and then secure. (See *Figure 2*).

The center pier and bottom sealing ring should now be grouted in place with a non-shrink grout and allowed to cure for 24 hours.

Check the bolt circle of the center pier top flange drive mounting studs to verify concentricity with the center pier. If the bolt circle is not concentric, call Siemens Customer Service. (See the contact list in the GENERAL INFORMATION section.)



PLUMBING THE CENTER PIER

Figure 1

ASSEMBLY SEQUENCE OF CENTER CAGE AND MANIFOLD

If the manifold or center cage assembly were not first in the tank, proceed as follows when center pier grout has cured:

1. Lower the manifold over center pier, taking care not to disturb the pier setting. Rest the manifold on 1/4" (6 mm) thick supports (anything but steel) so that the bearing plate is not gouged.
2. Lower center cage section(s) over the center pier and bolt to the manifold.

NOTE: The manifold inlets are to be in line with the truss lugs located on the cage. If not in line, rotate cage and align before bolting.

3. Cage and manifold can be bolted together outside of tank and lowered in one piece.
4. If influent well is furnished in one piece, place it over center pier/cage before drive unit is installed.

The seals are to be installed after the true plane of rotation has been established.

SETTING THE DRIVE ON THE CENTER PIER

Run a leveling nut and washer down each stud on the top flange of the center pier. The washers are to be at the bottom of drive elevation shown on the General Arrangement Drawing. Set with a machinist's level and straight edge long enough to reach diametrically opposed washers.

Orient the drive unit with respect to the bridge anchor bolts in the tank wall and lower the drive onto the center pier leveling washers. Check to see that all washers bear against underside of the drive base. Run a washer and full hex nut down each projecting stud and turn the nuts finger-tight. The drive elevation may have to be altered in subsequent final adjusting.

DO NOT GROUT THE DRIVE UNTIL THE ASSEMBLED MACHINERY HAS BEEN ADJUSTED TO RUN IN A TRUE PLANE.

DRIVE UNIT MAIN HOUSING ON CENTER PIER

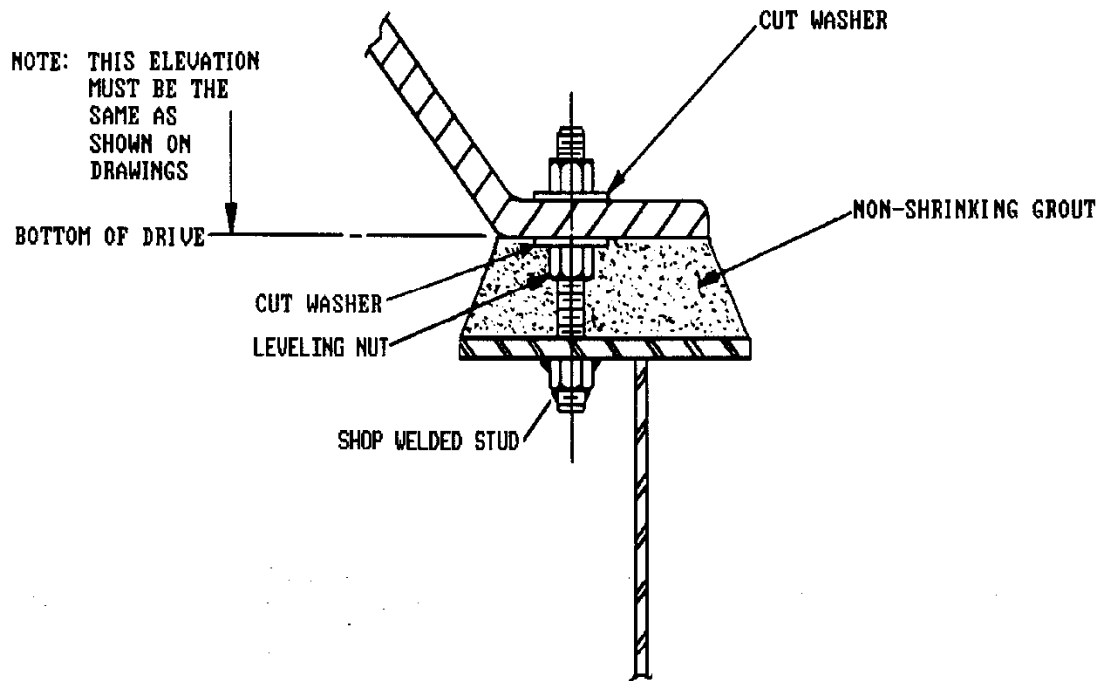


Figure 2

ASSEMBLING THE CENTER CAGE TO DRIVE

Lift the center cage up and secure to the final drive. Hand tighten the nuts at this time.

NOTE: Standard cage lengths are detailed and fabricated in one-inch increments. Shim packs for the cage-to-drive connection have been furnished to compensate. Shim to obtain proper clearance between unitube header and the finished floor and to obtain concentricity at the manifold seals.

INSTALLING MANIFOLD ON TOW-BRO UNITS

Raise the manifold and secure it to the bottom of center cage if not already completed. Note that the bottom of the manifold is to be horizontal and must clear top surface of the bottom sealing ring by no less than 1/2" (13 mm.). Measure this vertical distance around perimeter of manifold. If it is not constant within +/- 1/16" (1.5 mm), shim between the top of the manifold and the center cage to attain that condition.

Check concentricity between center pier and clearance hole in manifold top plate. Concentricity should be within 1/4" (6 mm). If not, make note and recheck after the unit has been adjusted for horizontal plane. If at that time concentricity is not within 1/4" (6 mm), shim top of cage.

BRIDGE INSTALLATION

TRUSS BRIDGE, WITH PLATFORM

Using a transit, sight in the center of drive, center pier and center pier anchors. Carry this to the tank wall, locate and install bridge anchors. After anchors have cured, level and adjust the bridge base plate to the correct elevation. Place the bridge slide plate over the base plate. Using care not to knock the center pier out of plumb, install center platform to drive using the required hardware **and plate washers** as indicated on the Field Connection Drawing. Install pony truss over slide plates and bolt to platform.

BRIDGE INSTALLATION NOTES

1. The bridge is rigidly secured to the drive unit/platform, but has a sliding "expansion" joint at the tank wall. The wall anchors must have pipe spacers installed to prevent binding of the bridge during expansion/contraction. Insure there is sufficient space at end of bridge for expansion. If, due to misalignment of the anchor bolts, sufficient room does not exist, then the slotted holes will have to be enlarged. If stairs or other appurtenances are attached to the bridge, then provisions for expansion/contraction must be made by the supplier of those items.

The bridge must be level within +/- 1/4" (6 mm) and the bridge beams/chords should be level to each other within +/- 1/8" (3 mm).

2. Bridges with Floor Plates. Floor plates should be laid on bridge loose, per item numbers indicated on the General Arrangement Drawing, and gaps adjusted for even spacing. The plates are furnished with a standard hole spacing to minimize field drilling of attachment holes. It is anticipated some field drilling will be required. Contractor is to install minimum amount of clips required to secure floor plate and eliminate possible trips. If required, floor plate can be bolted directly to bridge structure, but should be limited to one connection per plate so as not to inhibit expansion/contraction of floor plate.
3. Bridges with Grating. Grating panels should be laid on bridge loose, per item numbers indicated on the General Arrangement Drawing, and gaps adjusted for even spacing. Fasten with clips and stainless steel, self-drilling screws.
4. Install the handrail per the Field Connection Drawings and the vendors instructions.

PRE FEDWA BAFFLE OR INFLUENT WELL INSTALLATION

Install well support channels to cage per General Arrangement Drawings and Well Fabrication Drawing. Support channels and cross support beams of larger wells are cambered and care should be taken when installing.

FEDWA BAFFLE INSTALLATION

Install the FEDWA baffle per the General Arrangement, Detail and Field Connection Drawings.

INFLUENT WELL INSTALLATION

ROTATING TYPE, CAGE SUPPORTED

Attach hanger rods to supports. Hang well sections in an alternating, counterbalancing progression. Note; some larger wells require having well stiffener splices field drilled or welded to maintain concentricity. These wells should be assembled on the tank floor and adjusted for concentricity before hanging.

NOTE: It is important to hang the well in an alternating, counterbalancing progression. If two cranes are not available to support one well section while the other is being placed, then a method of tie-down or counterweights must be used. Failure to do so could damage platform to drive connection.

FIXED TYPE, BRIDGE/PLATFORM SUPPORTED

Follow platform/bridge installation instructions. Hang all cross support beams, hanger rods and knee braces, if required. Note; some larger wells require having well stiffener splices field drilled or welded to maintain concentricity. These wells should be assembled on the tank floor and adjusted for concentricity before hanging.

NOTE: It is important to hang the well in an alternating, counterbalancing progression. If two cranes are not available to support one well section while the other is being placed, then a method of tie-down or counterweights must be used. Failure to do so could damage platform to drive connection.

ASSEMBLING SKIMMER TRUSS OPPOSITE TOW-BRO HEADER

Lower all the truss sections and plow blades into the tank and locate and assemble these components in the position shown on the General Arrangement and Bolted Connection Drawings.

NOTE: Assemble skimmer support trusses opposite the header at the same time the header is installed so that when all of the necessary components are assembled and tensioned and supports are removed, an equal load is acting on both sides of the unit.

It is imperative that the lower chord members of the trusses are parallel to the slope of the tank floor **unless the drawings specify otherwise**.

NOTE: The General Arrangement Drawings and Bolted Connection Drawing indicate that shims can be placed between the flanges of the lower joints of adjoining truss sections. Use shims to keep the truss parallel to the tank floor if necessary.

Shimming should result in the lower chord angles all being **in line**. If, after shimming, any are cambered downward, start with the **section** joint nearest the pier, **jack up** the low end of the truss section and add shims. Once the lower chord angles have been brought into line, they must then be made parallel to the floor. Jack up and support each section directly under the joint until the lower chords are parallel to the slope of the floor. When this is accomplished, **then** make adjustments at the TIE CHORD "A"-FRAME CLEVIS to **maintain** the new position. This clevis **is not** intended to be used as a jack. It is only an adjustable supporting device.

Do not apply the finished tank floor grout at this time.

ASSEMBLING UNITUBE HEADER (S) - TIE BAR SUPPORTED UNITS

Lower all header(s) and truss sections into the tank and locate these components in the approximate positions shown on the General Arrangement Drawing.

If two or more unitube headers are used on a Tow-Bro Clarifier, each header section that comprises a completed header assembly will be match-marked so that sections from one (1) header cannot be inadvertently assembled to sections of another.

Block up header sections so that they can be joined to the manifold and to each other without putting any load into the manifold.

Assemble scraper trusses or skimmer support trusses opposite the header at the same time so that when all of the necessary components are assembled and tensioned and supports are removed; an equal load is acting on both sides of the unit.

The following general rules apply to the relationship of the rotating equipment and the tank floor:

1. Unitube header **should always** be set **parallel** to the finished floor.
2. Truss opposite header for skimmer support only **should always** be installed **parallel** to the finished floor.
3. Truss opposite header for skimmer and scraper blade support should always be set **parallel** to the finished floor.

The Tow-Bro header(s) and tie bars can now be assembled. Use silicone caulk, furnished, when bolting the sections together. Bolt sections in place using suitable blocking between header and tank floor, so that no strain exists at the manifold. Erect tie bars (if furnished) and tighten. The header must be straight and must not be pulled out of line by unequal tension on the bars. The header should be checked for proper height at all points. The header lip will slope toward the manifold. It should be higher at the outer end to conform to the designed slope of the tank floor.

SCUM TROUGH INSTALLATION

Install the weirs and scum baffles first, and then attach the scum trough to the scum baffles. Connecting bolts for this assembly should not be torqued to final values; this will allow later adjustment to obtain concentricity with the hinged skimmer. There must be no bolt heads, weld beads or other projections on the inboard surface of the scum baffle that could interfere with the rotating scum skimmer.

FLUSHING DEVICE

Install flushing device per the General Arrangement and Field Connection Drawings. Also Refer to the Flushing Device Operation Drawing.

SCUM BLADE INSTALLATION

Scum blades are usually supported by "A"-frames bolted to the scraper trusses. Various designs are furnished. The type for your unit is shown on the following: General Arrangement, Surface Skimmer and Bolted Connection Drawings.

When installing the scum blade, the following sequence is suggested.

1. Locate and field drill or weld "A"-frame support clips to truss arms per General Arrangement Drawings.
2. Bolt the "A"-frames to the truss, temporarily blocking them in position until the assembly becomes self-supporting. Install pipe supports loosely to "A"-frames.
3. Clamp the scum blade to "A"-frame pipe supports. Locate clamps so "A"-frames are vertical. Set scum blade elevation as indicated on General Arrangement Drawing. If well is rotating, field drill or weld scum blade to well. Continue to snug all bolts as adjustments are made.
4. Tack weld vertical pipe supports to U-bolts after all final adjustments are made and verified.

HINGED SKIMMER INSTALLATION (*Figure 3*)

To install the hinged skimmer assembly **1**, rotate the fixed scum blade **2** to a position in line with the scum beach. Bolt the tube support **3** of the hinged skimmer assembly to the long upright pipe supports of the A-frame **4**. The skimmer blade and side wipers **5** must be free to move through the scum trough without any binding. Level the skimmer blade **6** using the adjusting bolts. The skimmer blade should be set with 3" (76 mm) (4" [102 mm] including wiper) submergence below the maximum water level unless indicated otherwise on the General Arrangement Drawings. The spring loaded hinged guide **7** should contact the inner side plate of the scum beach as the skimmer travels through the beach. Positive contact can be maintained by preloading the hinged guide spring or by adjusting the location of the mounting plate on the skimmer support tube **3**. Rotate the collector and adjust the spring loading if necessary.

After final adjustments are made, tack weld all U-bolts to vertical pipe supports.

Some of the following adjustments may be needed after the tank is filled and the actual operation observed.

1. Horizontal adjustment of the hinged guide and adjustment of the guide spring to insure constant contact with the inner wiper.
2. Lateral skimmer blade movement through adjustment of the spring tension.
3. Skimmer setscrew adjustment to regulate the depth of the blade after passing over the scum trough. The blade should extend 3" (76 mm) (4" [102 mm] including wiper) below the maximum water surface.

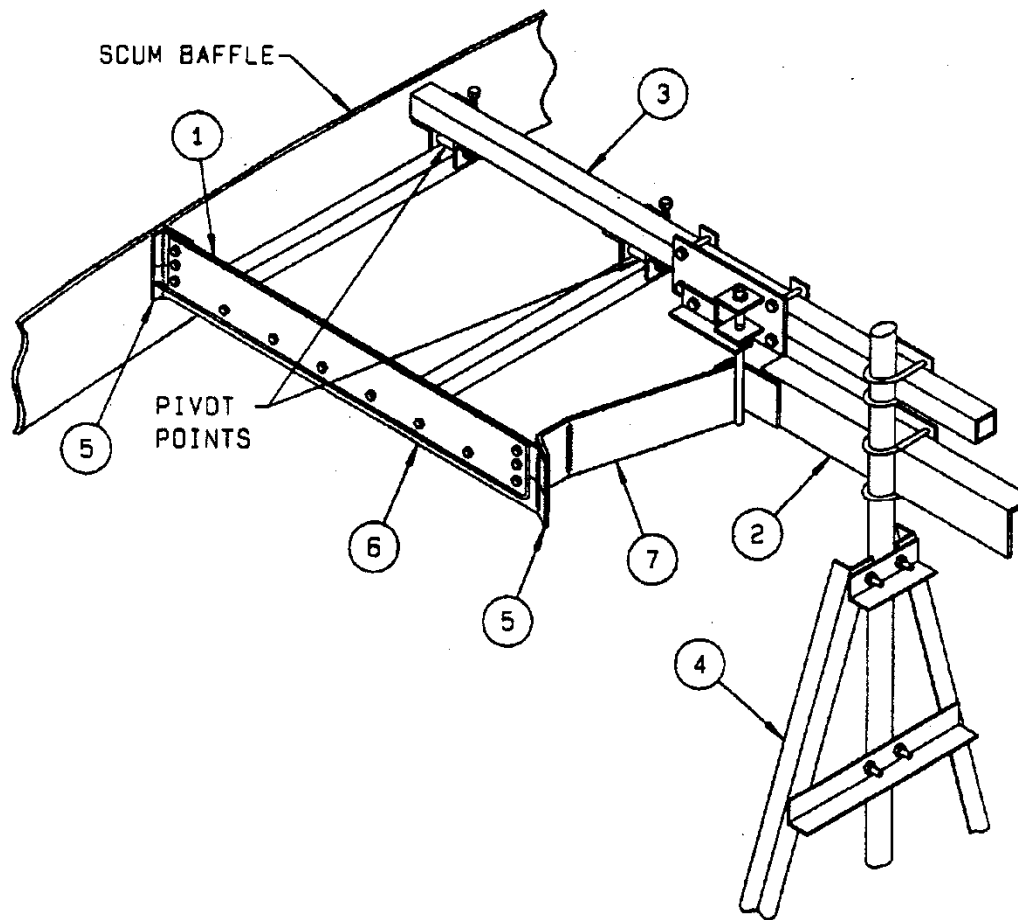


Figure 3

COUNTERWEIGHT INSTALLATION

Most mechanisms are not symmetrically loaded and, therefore, counterweights are required to balance the rotating portion of the unit. The location and quantity of counterweight plates is indicated on the first sheet of the General Arrangement Drawings. If the quantity is not indicated, the total number of plates shipped divided by the number of clarifiers is the quantity of weight per tank. The mounting arrangement and hardware is illustrated on the Field Connection Drawing.

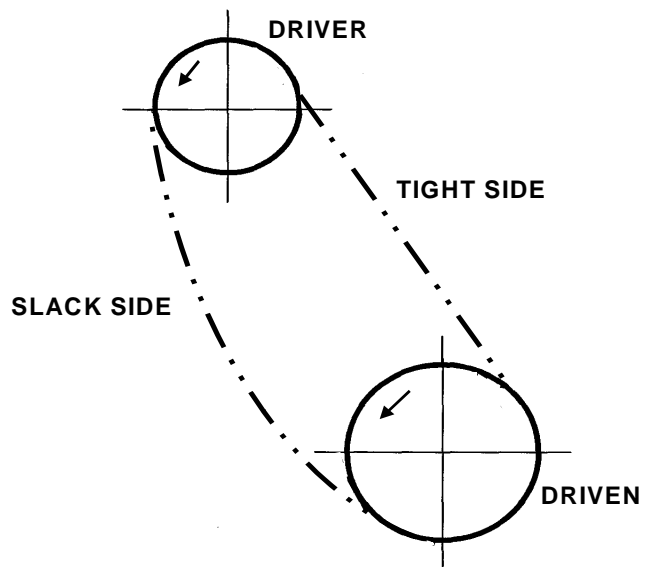
DRIVE CHAIN INSTALLATION

Proper installation of power drive chains is important.

The correct amount of slack is essential to the proper operation of chain. See *Figure 4*. Unlike belts, chain requires no initial tension and should not be tightened around the sprockets. Properly adjusted chain drive should permit slight flexure by hand in the slack strand.

When chain is too tight, the working parts carry a much heavier load than is necessary. This causes rapid chain wear because of increased pressures in the joints. In addition, this condition overloads and accelerates wear in the shaft bearings.

Check the alignment of sprockets with a straight edge applied to the machined surface of the sprockets.



CW COLLECTOR ROTATION

Figure 4

ADJUSTING FOR TRUE PLANE ROTATION

Now that the unit is assembled, it should be in static balance. With the unit in static balance, you can proceed to adjust the machinery to rotate in a true horizontal plane.

Before the drive can be grouted to the center pier or the tank floor can be finish grouted, the scraper arms must be adjusted to revolve in a true plane. Refer to *Figure 5*. At this time, all rotating machinery, including surface skimmers, counterweights, etc., should have been assembled and the machinery checked for balance. In the following procedure, you will be working with the unitube header to establish true plane rotation. After the drive mechanism has been adjusted, the rotating members are merely adjusted for slope parallel to the floor.

1. Using a transit, establish benchmarks on the tank wall at four (4) compass points at a convenient elevation (*Figure 5*). If the tank is very large in diameter, establish six (6) or eight (8) benchmarks; see *Table 1*.
2. Note the relationship between a point on the top of the arm and the benchmark at compass point 0°.
3. Rotate the arm through 360° and note the above-mentioned relationship at each of the benchmarks. The variations from true plane rotation should all be within the tolerances shown in *Table 1*.

CAUTION: Do not turn the unit by pushing on the truss arm or unitube header. Hand turn the worm shaft to avoid damage to the drive. (If **Siemens** service personnel are scheduled to assist in the check-out, have temporary power available. The service technician can safely run the drive without the torque overload devices completely installed.)

4. If the variations exceed the tolerance, change the plane of rotation by adjusting the leveling nuts under the drive housing on top of the center pier. Be sure all leveling washers bear against the underside of the drive housing before retightening the top nuts.

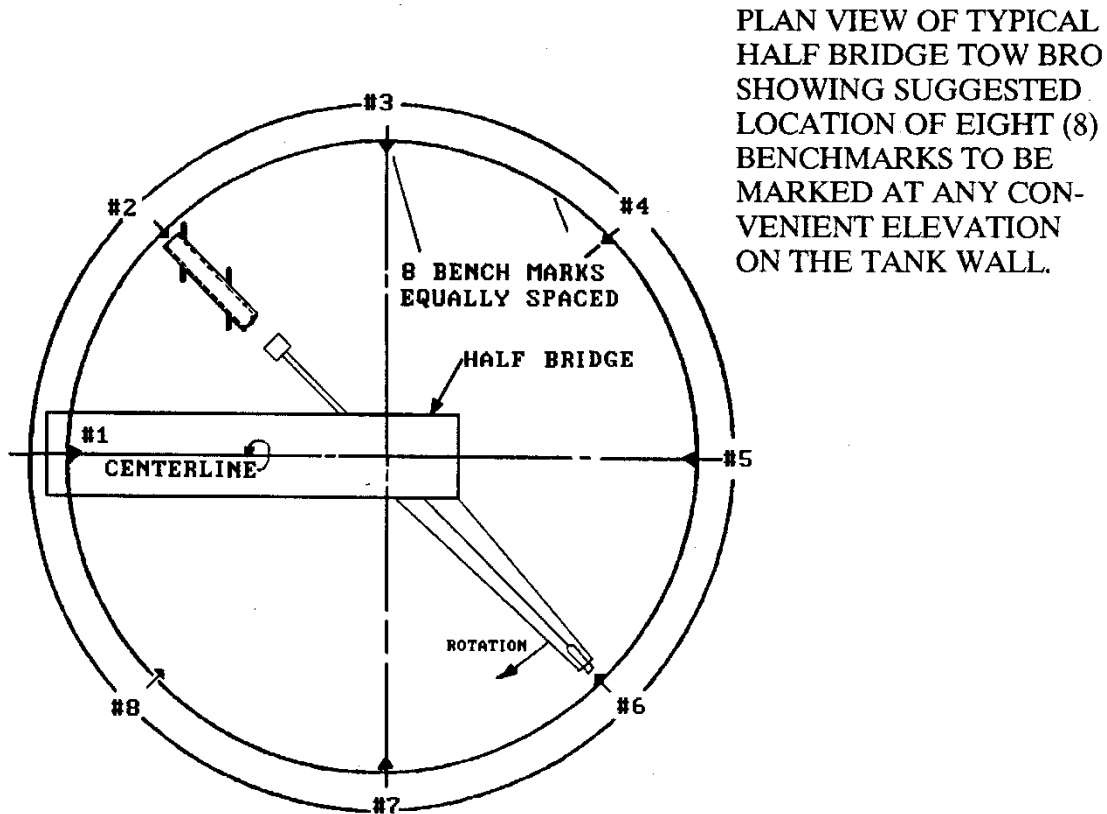


Figure 5

5. Recheck variations through full 360° rotation. If they now fall within tolerance, secure the top nuts per the Fastener Installation Instructions. **DO NOT** grout the drive at this time.
6. If, in making the final adjustment (#4 above), the opposite arm is no longer parallel to the floor elevation, change its slope by adjusting the tie chord A-frame clevis between the center cage and truss arm. Use jacks to raise the scraper truss section and adjust the tie chord A-frame clevis nut. **DO NOT** use the turnbuckle on the A-frame as a jack.

7. Check that the center cage revolves concentrically with the center pier; make four horizontal measurements, one from the outside surface of the pier to the inside vertical leg of each horizontal angle at the bottom of the center cage. If those measurements are the same within 1/8" (3 mm), torque the center cage/drive connection nuts per the Fastener Installation Instructions.

If two of the four measurements differ from the other two by more than 1/8" (3 mm), it will be necessary to add filler plates between final drive gear attachment lugs and center cage attaching plates on the side(s) opposite smallest measurements.

Recheck the measurements after shimming. If they are now within 1/8" (3 mm) of each other, torque fasteners per the Fastener Installation Instructions. The center cage is now concentric with center pier. **Do no more shimming at these four joints throughout the balance of erection.**

8. Install the manifold seals. The seals should contact the manifold top and bottom sealing ring at approximately 45° to form a resistive fit, as shown in *Figure on next page*. Lap the ends of the seal material 6 to 8 inches (152 to 203mm) and trim off excess
9. Recheck the influent well for level and designed elevation if it is attached to the cage.

After true plane of rotation has been established, grout the drive base. (See *Figure 2*) If check-out by a **Siemens** service technician is included in your contract, **DO NOT** grout the drive base until after the installation is checked.

PLANE OF ROTATION TOLERANCE TABLE

TANK DIAMETER	NUMBER OF BENCHMARKS	VARIATION FROM TRUE PLANE
120' (36.4 M) DIAMETER AND OVER	8	+ /- 3/4" (19 mm)

Table 1

TYPICAL CENTER COLUMN ASSEMBLY

NOTE: Install clamps every 3 ft. (914 mm) tighten in an alternating fashion to ensure all band segments are equally tight. In addition, screw band and seal to collar/manifold with $\frac{1}{4}$ " self-tapping screws, placed every 3 ft. (914 mm). See General Arrangement Center Pier Detail Drawing and Field Material Drawing for project specific details.

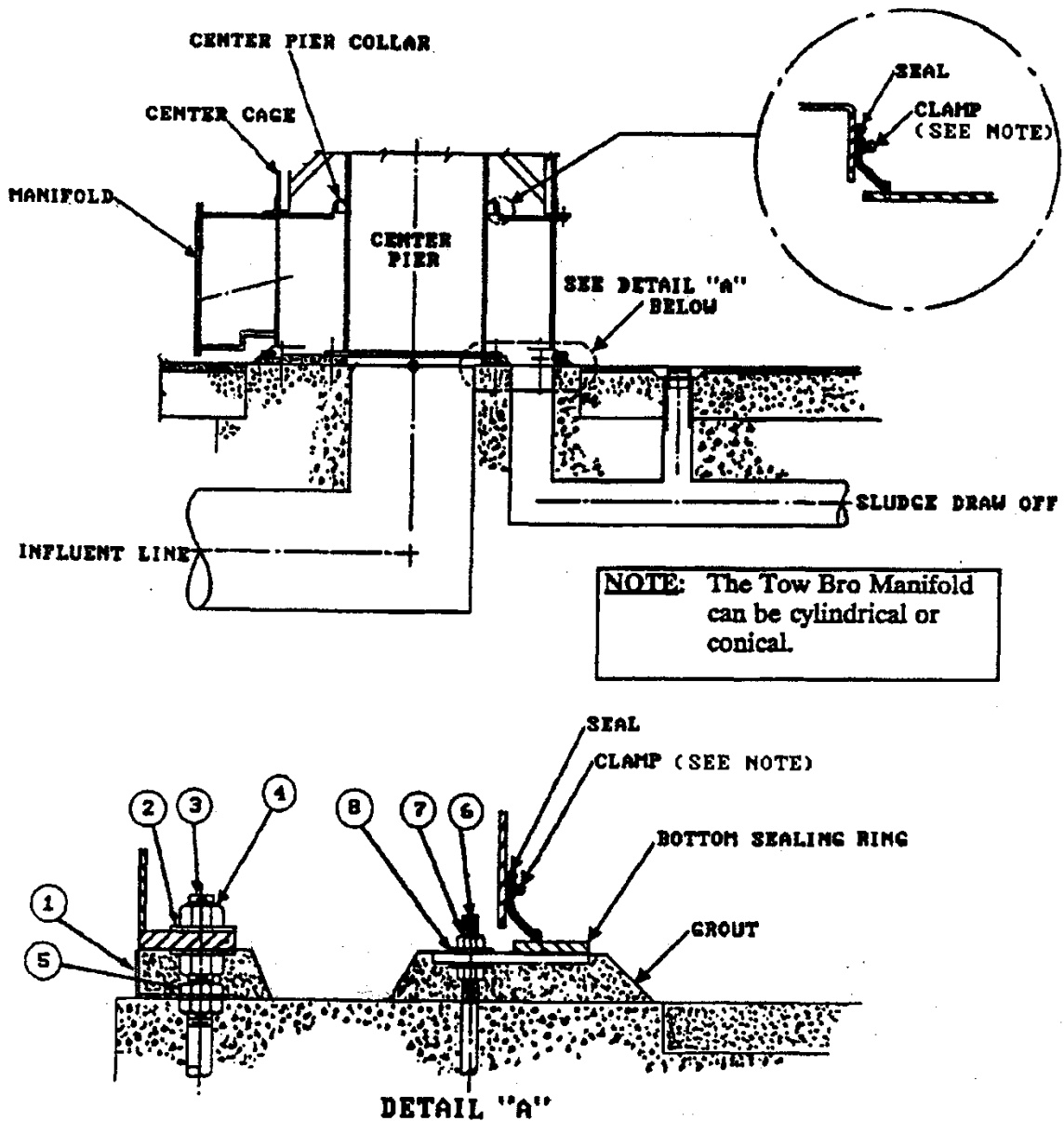


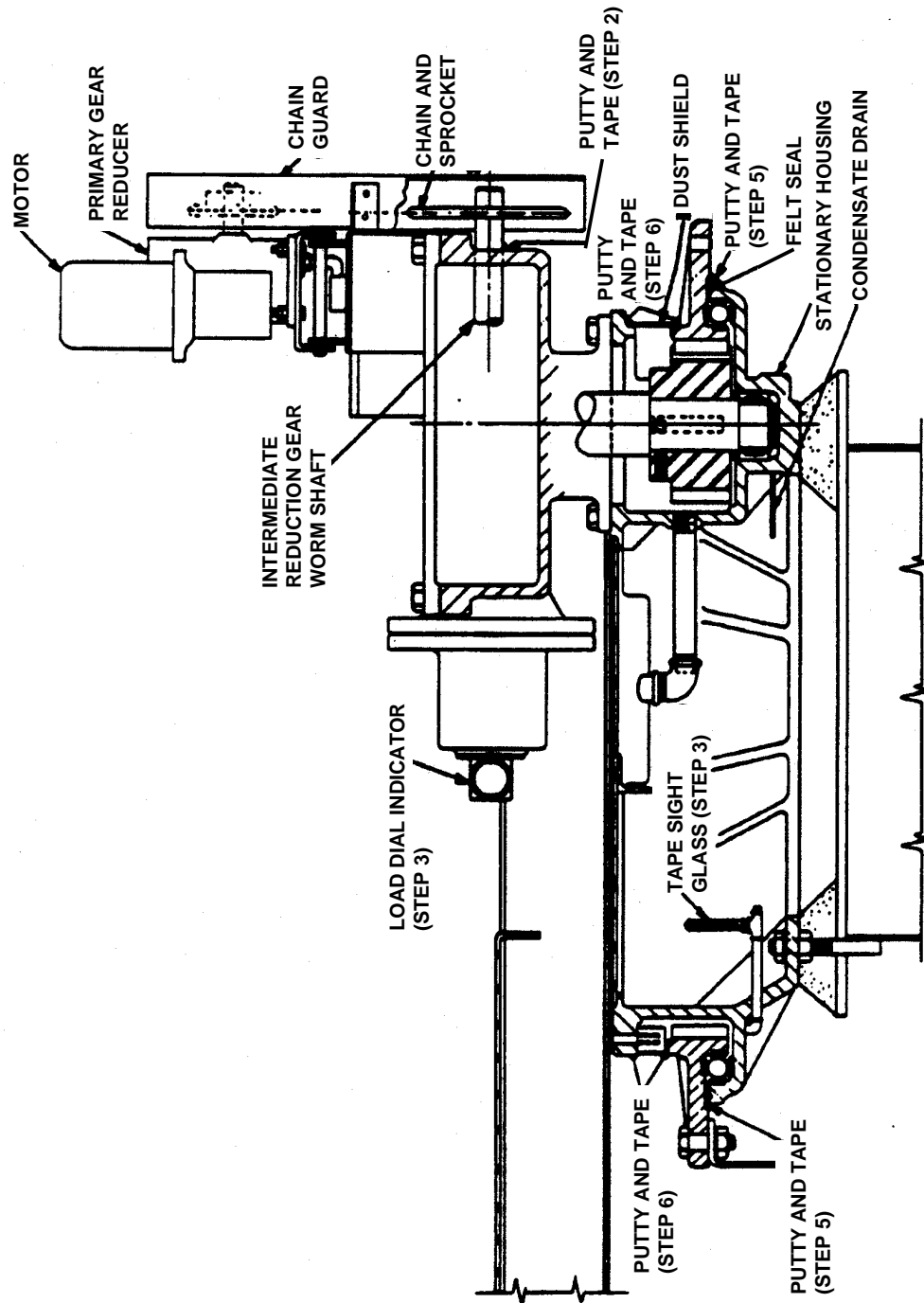
Figure 6

DRIVE UNIT PROTECTION FOR BLAST CLEANING

If it is necessary to blast clean the equipment in preparation for painting, the drive must be sealed against the entrance of grit. Grit in the drive will cause premature wear. Refer to *Figure 7* and take the following steps before blast cleaning.

1. Remove the primary gear reducer, motor, chain, sprockets and chain guard.
2. Apply plumber's putty, followed by two layers of duct tape, at the worm shaft seal of the intermediate reduction unit. Also, protect the shaft itself with two layers of duct tape. This sealing system will stand up under misdirected blasting and is relatively easy to remove.
3. Protect all oil sight glasses, air vent, grease fittings and drive load dial indicator with two layers of duct tape.
4. A felt seal between the stationary housing and the rotating turntable protects the turntable bearing during operation. The felt seal cannot withstand blasting and must be protected with plumber's putty and two layers of duct tape.
5. The upper and lower edges of the dust shield must be sealed with plumber's putty and two layers of duct tape.

After blast cleaning, remove the tape and putty from the shaft, felt seal joint and dust shield. Solvent clean the surfaces which have been puttied before painting the surface. Duct tape can remain on the other protected areas until painting has been completed.



TYPICAL H-DRIVE

Figure 7

PREPARING DRIVE UNIT FOR OPERATION

1. Drain the primary reducer oil to proper level per the manufacturer's recommendation in the **VENDOR INFORMATION** section of this manual.
2. Drain any condensation and site-added oil from the intermediate and final reduction units. Drain plugs are in worm gear drive (upper) housing street elbow and in the final drive (lower) sight gauge tee. See the Drive Assembly Drawings in the manual pocket to facilitate locating all fill and drain plugs. Flush the secondary and final drives with a mixture of 5% Mobil Oil Corp. Mobil System Cleaner and 95% 10W-30 motor oil. Drain and refill to sight gauge levels with seasonably appropriate lubricant. See the MAINTENANCE section of this manual for recommended oils and greases. **NOTE: Overfilling of oil will result in oil leaking into the clarifier.**
3. Refer to the Drive Assembly Drawings to locate fittings and re-grease all bearings sparingly. Use a low pressure, high volume gun (3 or 4 pumps) to purge all bearings. It is not necessary to regrease electric motor bearings unless they have been stored for more than 6 months - if necessary, regrease sparingly. Use the method and lubricant in accordance with manufacturer's bulletin found in the VENDOR INFORMATION section of this manual to lubricate the electric motor.

CAUTION: After removing the chain from the drive unit, determine the proper rotation once temporary power is available.

4. Microswitches in the worm gear drive (upper) unit can be set now so that the unit can be safely power driven in subsequent erecting procedures. See the Specification and Torque Overload System Drawing for settings for your drive. Refer to the detailed setting instructions in the following pages for making these adjustments.
5. If power is not available, remove the drive chain so the circular drive can be turned by hand in subsequent erecting procedures.

CAUTION: DO NOT TRY TO TURN THE DRIVE BY PUSHING ON THE TRUSSES--HAND TURN THE WORM SHAFT. If Siemens Field Service personnel are present, temporary power may be used to rotate the mechanism.

CAUTION: Drive unit should never be operated in reverse rotation. Torque overload protection is not functional and damage could occur to both structure and drive unit.

TORQUE OVERLOAD MICROSWITCH DEVICE (*Figure 8*)

CAUTION: **DO NOT** operate the equipment unless the torque overload switches have been **checked** and **electrically connected** to the drive. If your contract includes check-out by a **Siemens** Service Technician, do not operate the mechanism until the field check-out is completed.

CAUTION: The torque overload device is **only** operational when the equipment is operating in the designed direction of rotation. Reversing the mechanism can severely damage the drive unit and/or structure.

CAUTION: **DO NOT** adjust microswitch gaps at time of overload condition or without first consulting factory.

The torque overload unit is located in a separate housing opposite the driven end of the worm shaft. The device consists of two microswitches **1** mechanically actuated by lineal movement of the worm shaft **2** riding against a spring plate **3**.

One microswitch - normally OPEN - should be connected to activate an alarm when a predetermined load is reached. The other microswitch - normally CLOSED - should be connected to shut off the motor if torque loading continues to increase. The torque loadings have been determined for your equipment and related feeler gauge settings for both microswitches are given on the Specification and Torque Overload System Drawing. Also refer to the sectional views in *Figure 9* for component positions.

A dial indicator **4** is attached to the outside of the microswitch housing. It reads inches of spring plate deflection, which relates to torque. It has "ALARM" and "STOP" decals attached to its face. Noting the position of the dial pointer relative to the markings on the decal will give the operator an indication of fluctuations in torque.

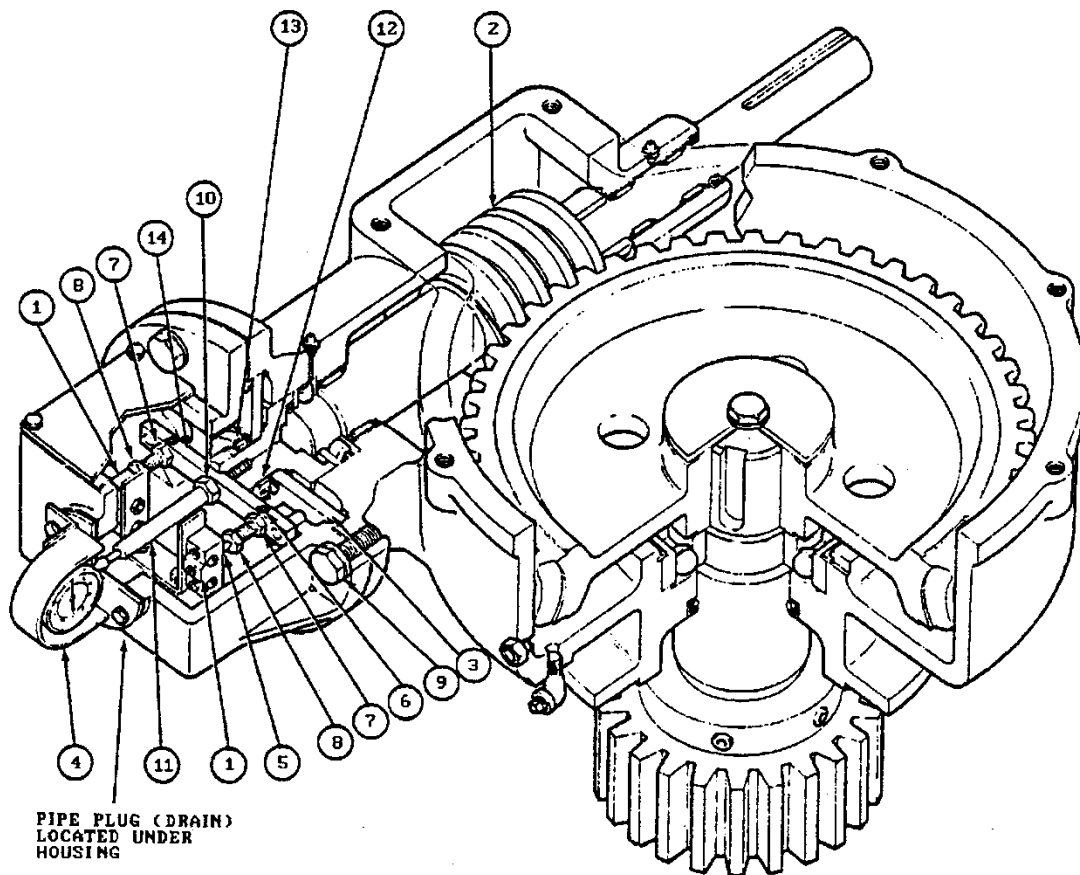
TOOLS REQUIRED TO SET MICROSWITCHES

1. Test light
2. Set of feeler gauges
3. Set of Allen wrenches
4. Set of small open end wrenches



Electrical circuits may be energized in the torque overload control box even though the main power is off. Always check for live contacts before making adjustments within the box.

- | | |
|--------------------------|-----------------------------|
| 1. Microswitch | 8. Capscrews - Switch Trips |
| 2. Worm | 9. Flange Bolts |
| 3. Spring Plate | 10. Locknut |
| 4. Dial Indicator | 11. Plunger |
| 5. Gap/Switch Pre-Travel | 12. Spring Plate Retainer |
| 6. Setscrew | 13. Locknut |
| 7. Jam Nut | 14. Trip Bar |

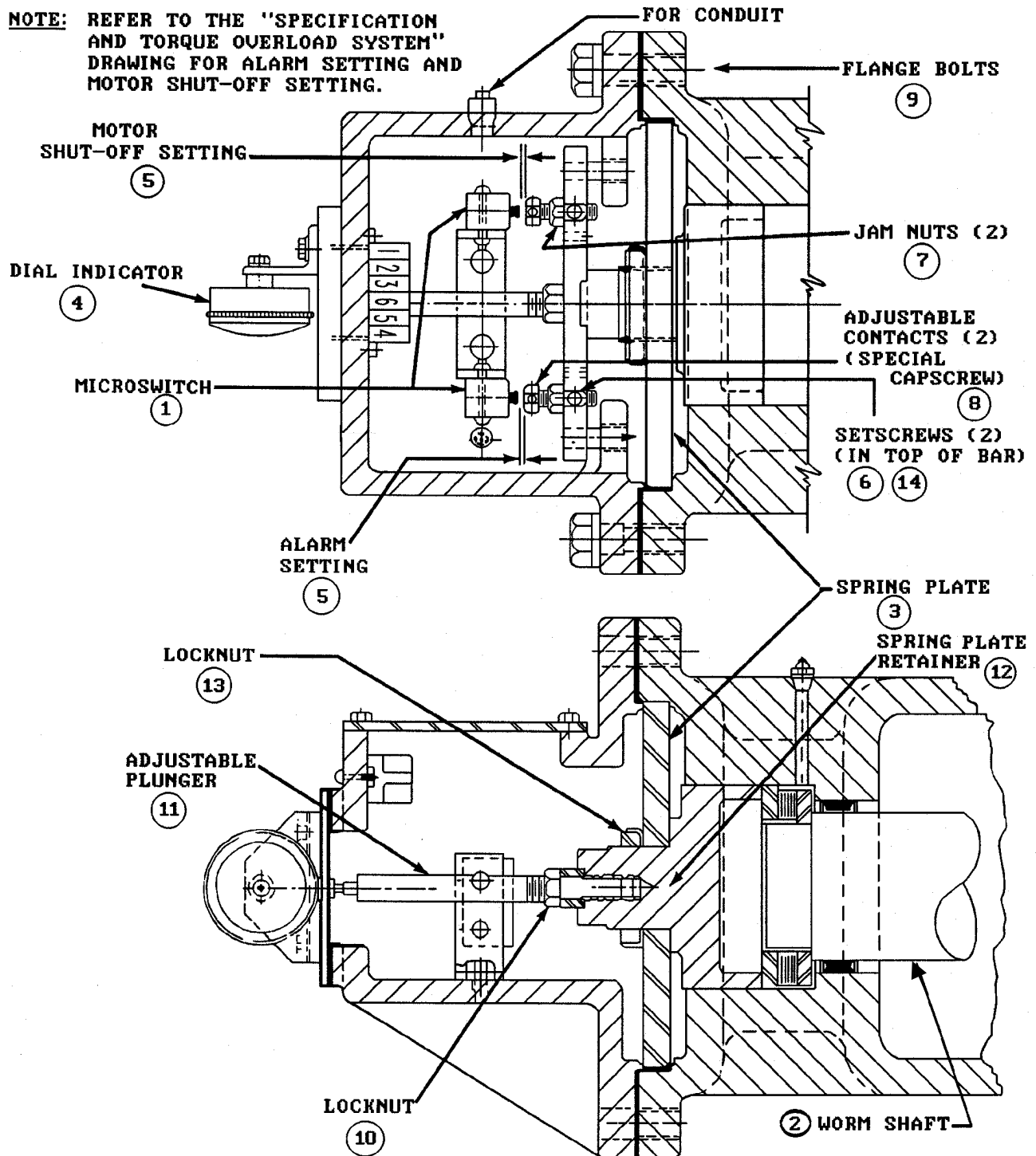


TYPICAL TORQUE OVERLOAD DEVICE

Figure 8

INSTALLATION

NOTE: REFER TO THE "SPECIFICATION AND TORQUE OVERLOAD SYSTEM" DRAWING FOR ALARM SETTING AND MOTOR SHUT-OFF SETTING.



ADJUSTING TORQUE OVERLOAD SWITCHES

Figure 9

PROCEDURE FOR SETTING THE MICROSWITCH GAPS (*Figures 8 and 9*)

1. Pre-travel in microswitches varies considerably, so it should be understood beforehand that, after either switch is properly adjusted, no air gap may exist after the feeler gauge is withdrawn. Because of the pre-travel variation, use of a test light is a necessity, as the click from a microswitch is not always audible.
2. Refer to the drawings and connect the test light to alarm microswitch **1** leads. The test light should be OFF.
3. Refer to the General Arrangement Drawings for proper size feeler gauge for setting the alarm gap **5**.
4. Loosen setscrew **6** on top of bar **14**; loosen jam nut **7** on the adjusting capscrew and turn the capscrew **8 IN** until the feeler gauge will slide easily between the microswitch plunger and the head of the capscrew. Now, turn capscrew **8 OUT** (while the feeler gauge is still between the microswitch plunger and capscrew head) until the test light turns **ON**. While holding capscrew **8**, tighten setscrew **6**; also tighten jam nut **7** to the bar. Do not overtighten the jam nut as it could upset the adjustment.
5. To check the setting, proceed as follows:
 - a. Insert a feeler gauge that is .002" (.05 mm) less than the original gauge used; the test lamp should not light up. Once again, insert the original size feeler gauge and the lamp should light; if not, readjust.
6. Go to Step 1 and repeat the procedure to set the motor shut-off switch. (The test light is ON, but turns OFF when shut-off torque is reached.)

ZEROING THE DIAL INDICATOR (*Figures 8 and 9*)

The dial indicator **4** may have to be reset to zero several times during installation and initial operation. It should be checked after microswitch adjustment, drive wear in and shortly after the equipment has been rotating in a full tank.

To zero the indicator **4**, simply rotate the dial.

WHEN A TORQUE OVERLOAD CONDITION OCCURS (*Figures 8 and 9*)

If a torque overload develops that is severe enough to sound an alarm and shut down the drive unit, several steps must be followed to reset the dial indicator and microswitches.

First, use a proper lock-out tag-out procedure to disconnect power to the drive. Reverse the motion of the worm shaft in the drive by either removing the motor fan cover and rotating the fan in reverse or by removing the motor and rotating the coupler in reverse. **Do not use power to reverse the drive. Perform this reverse rotation by hand only.** Continue to rotate in reverse until the surface skimming arm moves backwards several inches and the dial indicator **4** reads zero. Care must be taken when moving the skimming assembly backward. If it is near the scum trough and beach, lift the skimmer over the trough if interference occurs.

After the mechanism has been reversed and the dial indicator reads zero, the load on the spring plate will be released and the microswitches should return to their normal positions. Power can be reconnected to the drive and the unit should be run forward under normal power. If the overloads trip again or if the unit cannot be manually reversed, it will be necessary to look for the cause.

There are numerous causes for drive overloads. The most common are high sludge loading or skimmer problems. Skimmers can hang up on the trough/ramp due to loosening of mounting hardware, misalignment or ice build-up on the trough or ramp. Other less common causes are from the mechanism jamming against pressure relief valves in the floor or walls of the tank. Loosened floor grout can jam the mechanism. In cold weather, the freezing of accumulated condensate in the unit's oil reservoir can jam the lower drive unit. If no cause for the overload can be determined, call **Siemens** Field Service Department for assistance.

If, after identifying and correcting the cause of the overload, the dial indicator would not return to zero, the spring plate **3** may be damaged. **DO NOT adjust the microswitch gaps without first inspecting the spring plate.**

DISASSEMBLY AND SPRING PLATE INSPECTION (*Figures 8 and 9*)

Remove flange bolts **9** and carefully withdraw the unit. The unit can now be further disassembled using the following steps.

1. Remove the dial indicator **4** from the housing.
2. Loosen nut **10** on adjustable plunger **11** and remove plunger from the spring plate retainer **12**.
3. Spring plate retainer **12** and spring plate **3** can now be removed from the housing.
4. Remove spring plate retainer **12** and locking nut **13**, and disassemble the spring plate from the spring plate retainer.
5. Check the spring plate for flatness; if deformed, replace it.

REASSEMBLY

Reverse the preceding procedure to reassemble. One test must be made before resetting the microswitches. This test is to be made with the drive under no load. When all but the dial indicator have been reassembled and installed, observe the dial needle. It should move at least a quarter turn as the indicator is being tightened down. If the needle does not move off the peg, loosen the nut on the adjustable plunger and screw the plunger out of the plate retainer until it moves the pointer one-quarter revolution. Hold the plunger while retightening the locking nut against the bar. The air gaps should now be reset as previously outlined.

OVERLOAD HOUSING VENT

The overload housing is equipped with a vent at the bottom. The vent allows condensation to drain from the housing to prevent corrosion.

NOTE: If the drive unit is explosion-proof, no vent is provided; the unit continuously drains through conduit access holes.

TORQUE OVERLOAD DEVICE

The unit is equipped with a shear pin sprocket. The shear pin number will be identified on the Drive Assembly Drawing or the List of Materials. The shear pin number will include a dash number and a series letter, e.g. CA1943-22E, CA680-1A, etc.; the last number and letter are marked on the end of the pin (*Figure 10*). Examine the shear pin end and compare the dash number and letter with the drawing. If a discrepancy occurs, contact the factory representative or the factory at once. Under NO circumstances should a shear pin of different value be substituted. **Failure to comply with this could severely damage the equipment and void any factory warranty.** Grease the sprocket bore and shear pin faces before operating the drive under load. Any major brand of Lithium based #2 may be used.

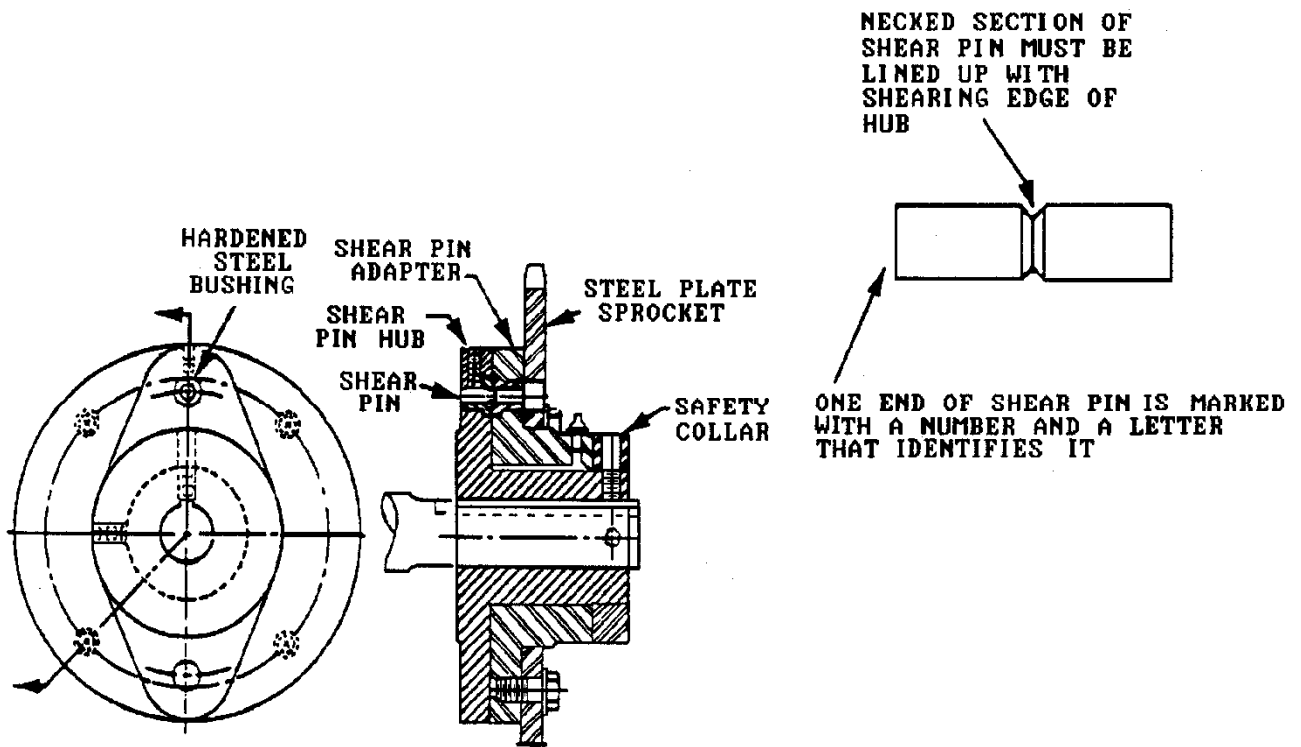


Figure 10

PRE-OPERATIVE CHECK

CAUTION: Even if running under temporary power, **do not bypass the overload devices of the unit.** Verify that the drive unit has been properly lubricated and that the housings are filled to the proper level with oil.

If power is available, we suggest operating the unit in a dry tank for at least two complete revolutions, or if possible, for a period of four hours, then check to see if the arm(s) are still operating on the same plane.

Lightly grease the flexible seal contact surfaces during dry tank operation.

During the dry tank run-in, check out the unit for the following:

1. Smooth operation - no stopping or jerking movement.
2. Overheating - the temperature of the reducer should not be uncomfortable to the hand. Motors must be protected by proper heaters in the starter.
3. Oil leaks through reducer seals or drain plugs.
4. Oil leaks through main drive unit drain plugs or level gauges.
5. Action of the surface skimmer as it traverses the scum beach.

GROUTING THE TANK FLOOR

Introduction

The purpose of the layer of grout on the floor of a tank is to provide a finished surface that conforms more closely to the scraper or suction header to promote better sludge removal. The instructions below are general in nature and should be used only as a guide.

Note: Siemens is not responsible for grouting the tank floor. Tank grouting is covered by the consulting engineer's specification; refer to the specification for information on grout material, and placement. **Siemens** does not have responsibility for approval of the floor grouting.

The clarifier equipment may be used as either a **screed** or a **screed guide**. From "Concrete Terminology", 2010 American Concrete Institute, the definition of **screed** is "1) to strike off a cementitious mixture lying beyond the desired plane or shape; 2) a tool for striking off the cementitious mixture surface, sometimes referred to as a strikeoff". A **Screed guide** is a "firmly established grade strip ... for unformed concrete that guides the strikeoff in producing the desired plane or shape".

Based on the definition of a screed **the header or scraper truss are not to be used to plow the grout layer into place on the tank floor.** Rather they are to be used to smooth out the very surface of the grout to create a flat floor surface at the proper slope and elevation. Following the definitions, a unitube header cannot be used as a screed as it will

deflect upward from the resistance of high spots in the grout and the floor will be uneven. If the header is supported by a truss, the additional weight and stiffness from the truss will permit it to be used as a screed. Headers that are not truss-supported can be used as a screed-guide.

PREPARING THE TANK

Prior to placing grout:

1. Remove any debris from the bottom of the tank, if necessary sweep up small loose material like sand and gravel.
2. If permanent power is available to the drive, the overload devices must be wired and operational.
3. The **Siemens** Service Technician checkout must be performed.
4. The drive should be grouted.
5. The drive should be serviced and all parts should be properly lubricated with the proper weight and amount of oil in the housings.
6. Horizontal plane of operation must be set for the rotating machinery.

Important: The rotating mechanism is used as a guide for proper placement of the floor grout. **The trusses and other steel components will be affected by changes in ambient temperature and solar gain. It is best to perform floor grouting when temperatures will remain relatively constant and the sun will not heat up the steel. Siemens** recommends doing this work on a cloudy day, or to begin very early in the morning.

NOTE : If you plan on using power to sweep in the finish grout, be advised that under no circumstance should the drive be run in reverse. The torque overload system is inoperative when the drive is reversed.

Header as Screed Guide

To use the header as a screed guide follow these steps:

1. Clean the tank floor thoroughly. Cover any sludge pit with plywood sheet. Cover any other holes in the tank floor that need to remain free of grout. Cover all of the orifice holes in the header.
2. Be prepared to wet down the floor area to be worked and ahead of the area being worked to help the grout bond to the floor.
3. Begin pouring the grout at the outside of the tank. Working inward in a spiral pattern to the tank center. **SPREAD AND TROWEL THE GROUT BY HAND.**
4. **Use the fluidizing blade** (the lip that projects from the bottom of the header) as the screed guide. Maintain the design clearance between the fluidizing blade and the finished floor.

5. Jog the clarifier drive to move the header forward as the grout is being spread. **Do not allow additional weight to rest on the header as it rotates.**
6. Grind down any high spots that may interfere with the fluidizing blade or the rubber extension.
7. Hand-trowel the areas around the sludge pit and the base of the tank wall.
8. Remove any grout splatters from the header and uncover the header orifices prior to operation of the clarifier.
9. When the grout has cured install the neoprene rubber fluidizing blade extension. Adjust the header deflector blade and the rubber extension to just touch the floor. *See Figure 11*

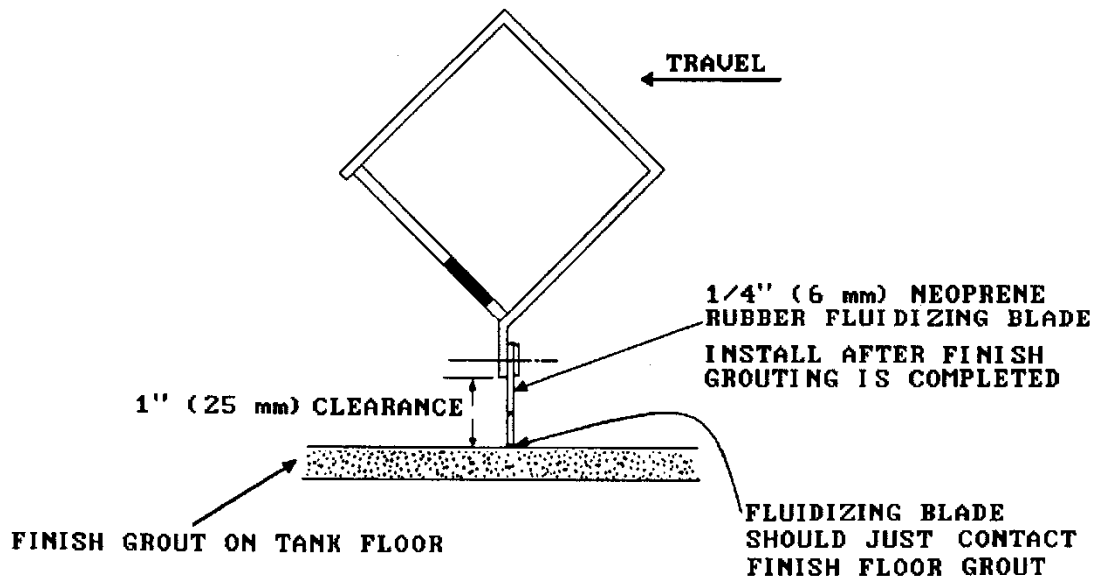
Header as Screed

Important Note: When the header is modified to add the screed/guide, the weight added to the mechanism on one side will change the plane that the mechanism rotates in. This must be compensated for by adding temporary counterweights on the side opposite. Details for this are in the following instructions.

To use the header as a screed follow these steps:

1. See *Figure 12* for a suggested method to construct and attach a screed to the header. Note that an orifice shield can be included with the screed. Other construction can be used that will work just as well.
2. Determine if the weight added to the header by the screed unbalances the machine. Add a pointer to the end of either truss at the elevation of the benchmarks used to adjust the machine to operate in a true plane of rotation. After the screed is installed, add counterweight to the opposite truss to bring the pointer to the proper elevation. An observer should walk behind the header during screeding to immediately alert workers if the pointer rises or falls. If this happens it must be corrected or the finished floor surface will be incorrect.
3. Clean the tank floor thoroughly. Cover any sludge pit with plywood sheet. Cover any other holes in the tank floor that need to remain free of grout. Cover all of the orifice holes in the header.
4. Be prepared to wet down the floor area to be worked and ahead of the area being worked to help the grout bond to the floor.
5. Begin pouring the grout at the outer wall of the tank. Working inward in a spiral pattern to the center of the tank. **SPREAD AND TROWEL THE GROUT BY HAND.**

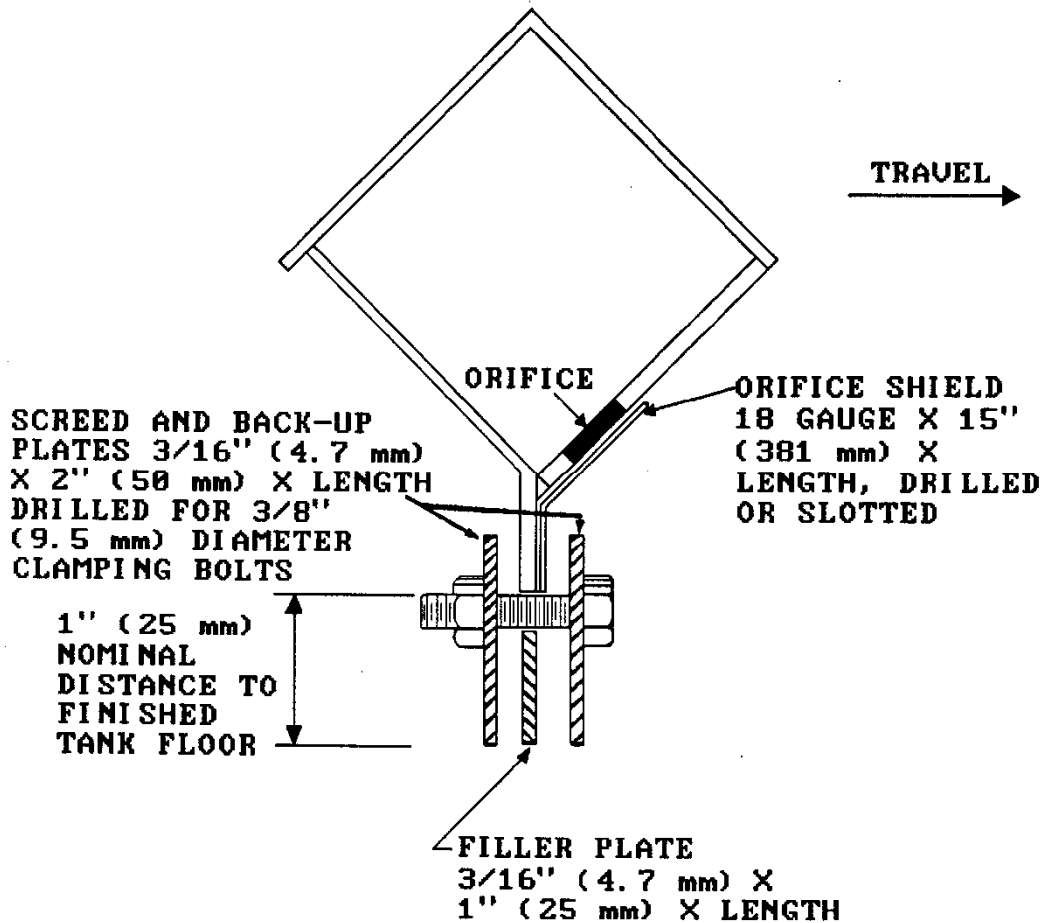
6. Jog the clarifier drive to move the header forward as the grout is being spread. **Do not allow additional weight to rest on the header as it rotates. The drive overload device must not be bypassed for any reason.**
7. Grind down any high spots that may interfere with the fluidizing blade or the rubber extension.
8. Hand-trowel the areas around the sludge pit and the base of the tank wall.
9. Remove any grout splatters from the header and uncover the header orifices prior to operation of the clarifier.
10. When the grout has cured remove the screed and install the neoprene rubber fluidizing blade extension. Adjust the header deflector blade and the rubber extension to just touch the floor. *See Figure 11.* Remove any additional counterweights that may have been added.



NOTE: REFER TO THE BOLTED CONNECTION DRAWING FOR EXACT LOCATIONS OF HEX HEAD CAPSCREW, FLAT WASHERS, FENDER WASHERS AND HEX NUTS.

TYPICAL SECTION THROUGH ASSEMBLED UNITUBE HEADER

Figure 11



CAUTION: Take care not to damage the galvanized finish on the header as this can lead to premature corrosion.

SUGGESTED SCREED
Figure 12

TORQUE TESTING PROCEDURE

If a torque test is required per the contract documents, a **Siemens** service technician will perform the following recommended torque test procedure.

Verify the circular equipment to be tested has been inspected for proper installation and the tank floor is free of debris. The overload switches **MUST** be wired into the alarm/shut-off circuit as required by the General Arrangement Drawings. With permanent power connected, operate the drive under power for a minimum of one full rotation and check for free and quiet operation of drive and structural components.

Inspect the torque test kit and verify all items are accounted for and undamaged.

Locate the attachment points on the truss/header per the dimensions indicated on the Torque Test General Arrangement Drawing. At those points, attach a polyester strap to the trailing bottom chord of the truss arm or header. Connect a hydraulic cylinder to the other end of each strap.

NOTE: The hydraulic cylinder should be in the fully retracted position. Locate each cylinder back away from the truss/header so the strap/cylinder is 90 degrees to the centerline of the truss. Mark and install anchors for the cylinder mounting brackets into the floor or the wall as required. The location of the attachment points and mounting of cylinders is very important and must coincide with the Torque Test General Arrangement Drawing.

Connect the hydraulic hose to the rod end port of the cylinder and the common tee/gauge assembly. Repeat the procedure with the other cylinder. Locate the pressure gauge assembly up on the bridge near the drive unit. Fill the cylinders and hose assemblies with hydraulic fluid at the gauge assembly, allowing trapped air to escape. Wire in the start/stop toggle switch into the motor circuit (**NOTE:** Lock out electrical power when connecting toggle switch).

The following procedure is required before the actual testing to properly set the spring plate into the overload housing. Start the drive and with the use of the start/stop toggle switch, gradually increase the torque, as indicated by the pressure gauge assembly, to operating pressure. Stop the drive and reverse the motor leads (**NOTE:** Lock out electrical power when reversing motor leads) to remove all load from the cylinders and truss arms/header.

TORQUE OVERLOAD CONTROL BOX



Electrical circuits are energized in the torque overload control box. Always check for live contacts before making adjustments within the box.

At this point, check and adjust, if required, the microswitch gaps per the Specification General Arrangement Drawing. Zero the torque/deflection dial indicator. Remove shear pin and verify it matches the size indicated on the Specification General Arrangement Drawing. Verify the shear pin hub is free to rotate before reinstalling the shear pin.

The torque test is now ready to be performed. Start the drive, and with the use of the start/stop toggle switch, gradually increase torque and pressure in the hydraulic cylinders. When the pressure gauge indicates a test point has been reached, verify the protective action, alarm sounding or motor shut-off has occurred. If not, adjust the designated microswitch setting to actuate at that point. Continue testing until the last test point has been reached.



The drive motor rotation should be reversed to remove the truss arm/header loading. Lock out electrical power when reversing motor leads. Be careful that the cylinder rod is retracted during the reversal to prevent any damage. **NOTE:** Drive overload protection is not functional when operating in reverse from normal rotation.

The **Siemens** service technician may repeat the test to verify the overload settings by reversing the drive to remove loading to the mechanism and restarting the test as described above.

Reverse the drive to remove loading to the mechanism before disassembling the torque test kit equipment.

After testing is completed, check that the motor is wired for proper rotation as indicated on the General Arrangement Drawings.

Remove or grind off the anchors that were holding the cylinder mounting brackets. This area must be smooth and not cause interference with rotating equipment.

SECTION 2 CONTENTS

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TANK FILL-UP	2-2
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EMERGENCY OPERATING SHUT-DOWN PROCEDURES	2-4

TOW-BRO[®] CLARIFIER, H-DRIVE

SAFETY PRECAUTIONS

The primary hazards associated with operating circular clarifying equipment are unsafe procedures used by personnel.

OPERATING ENVIRONMENT



Circular clarifying equipment is usually exposed to the elements. The bridge and other access points may become slippery when wet or icy. Handrails and other safeguards must be in place when operating the equipment. Use care when access is necessary.



The access area for drive maintenance is below the bridge deck level. The difference in level will depend on the bridge design. A falling hazard exists. Use caution when in or near the access area.

CHAIN GUARDS



Chain guards must be in place when operating **Siemens** equipment.

TORQUE OVERLOAD CONTROL BOX



Electrical circuits may be energized in the torque overload control box even though the main power is off. Always check for live contacts before making adjustments within the box.

START-UP

If the unit has been sitting idle for some time, either before initial start-up or after a winter shut-down, the following should be checked before filling the tank.

1. When tank is equipped with pressure relief plugs or valves in the floor, be sure these are closed.
2. Check the position of valves that control the hydraulics of the unit.
3. Check the position of the weirs. On initial start-up, they should be set at maximum height, so that after the tank is filled, they can be evenly adjusted to the design bottom of V-notch weir elevation. Tighten down the weir bolts after making this adjustment.
4. Check oil level in the reducers, note its condition and drain and refill if necessary. Be sure it is the correct viscosity for anticipated ambient temperatures in which the reducers will operate. Grease all fittings.
5. Be sure the dial indicator is set at zero, then start the unit.

NOTE: If your unit is equipped with an LVDT, Linear Voltage Differential Transmitter, be sure that the meter is zeroed out at this time.

CAUTION: When raw sewage is flowing or present in tank, operation of the unit should not be stopped for a long period of time without first draining the tank. This especially holds true when there is a large percentage of solids in the flow. A dense build-up of sludge on the tank floor can overload the drive, making it impossible to start up the unit.

TANK FILL-UP

1. Observe the action of the surface skimmer. Scum should move toward the hinged skimmer blade. The hinged skimmer blade should smoothly wipe the scum beach and carry the scum into the scum trough. It should be submerged no more than 3" (76 mm). As the scum blade enters, passes over and leaves the scum trough, there should be no tendency to hang up at any position if it is properly adjusted.
2. When the tanks are full, note and record the dial indicator reading. A normal pattern of readings should be established so that an overload condition can be anticipated and corrected.

WINTER OPERATION

Normally, the unit should operate the same during the winter as it does in other seasons. When ambient temperature falls below freezing, it is necessary that sewage flow to the unit is continuous.

When the weather becomes extremely cold, particular attention should be given to the scum beach and all skimming equipment. Torque overload devices are rated and set for the loading requirements of the submerged rotating equipment. Skimmer construction is based on lighter load requirements and can be damaged without activating the torque overload device.

CAUTION: The skimming equipment might be damaged from a build-up of frost, ice or snow. Temporarily remove the skimming equipment or tie it up so that it will clear any possible build-up.

It is imperative that all ice has melted from the tank before a start-up. The tank should be probed in as many areas as possible to determine whether any ice is present under the melted surface water. If it is possible to draw the tank down before start-up, break up all ice beforehand and then drain. Hose down the equipment in the tank and the tank itself. Examine the equipment for any ice damage. Repair or replace any damaged equipment. Check the tank floor for surface irregularities, which might have occurred due to heaving.

NOTE: SIEMENS ASSUMES NO RESPONSIBILITY FOR DAMAGE TO EQUIPMENT WHICH IS SUBJECT TO WEATHER CONDITIONS THAT MAY REQUIRE THE PROCEDURES SUGGESTED ABOVE. ONLY THE PLANT OPERATORS ARE IN A POSITION TO DETERMINE THE DEGREE OF EQUIPMENT PROTECTION REQUIRED. DAMAGE TO THE STRUCTURAL MEMBERS CAN RESULT IF ICE IS PRESENT AND THE TANK IS EMPTIED, PERMITTING ICE TO FALL OR LAY ON ROTATING MEMBERS OR ON THE TANK FLOOR.

SIEMENS DOES NOT RECOMMEND the use of fuel conditioning products such as "Diesel Heat" to thin or modify the gear oil in **Siemens** circular drives during extremely cold weather. This product sufficiently dilutes the oil (lowers viscosity) and inhibits the ability of the oil to maintain an oil film between moving parts. The gearing and ball bearings operate so slowly that a true hydrodynamic film cannot be developed and thus the thinned oil is literally "crushed" under the contact areas. When this occurs, the oil actually reaches its flash point and ceases to lubricate.

Also, it is not recommended flushing bull gears with oil during operation. The reasons for not doing it are the same as in the previous paragraph. Flushing with oil **while the unit is shut down is approved.**

SHUT-DOWN

When a shut-down is expected, the following procedure is recommended.

1. Drain the tank down, then turn off and lock out the drive.
2. Hose down the tank and all submerged equipment.
3. Inspect the submerged equipment for any damaged or missing parts. Fix and replace as needed.
4. Fill all reducers with the proper type lubricant, close vents and grease all fittings on the drives. Remove the motor and store it in a warm, dry place. Cover the reducer "C"-faced motor mount with a tarp. The motor and all reducer shafts should be rotated by hand 1-1/3 turns every 60 days.
5. If the tank floor is equipped with pressure relief plugs or valves, open them and also open the tank drain. If the tank is not so equipped, it will have to be sufficiently filled with water to prevent it from heaving. When prolonged freezing weather is expected during a shut-down, the tank should have continuous flow.

CAUTION: When raw sewage is flowing or present in tank, operation of the unit should not be stopped for a long period of time without first draining the tank. This especially holds true when there is a large percentage of solids in the flow. A dense build-up of sludge on the tank floor can overload the drive, making it impossible to start up the unit.

EMERGENCY OPERATING SHUT-DOWN PROCEDURES

If the equipment malfunctions, it cannot be permitted to continue to run. Follow the sequence of operation of the controls for the equipment and turn off and lock out the drive(s). Follow the Lock-Out procedures shown under the Safety Precautions in the MAINTENANCE section of this manual. Determine the reason for the malfunction and take corrective action. If a shut-down period is required to repair the situation, follow the plant procedures for taking the equipment off line.

SECTION 3 CONTENTS

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RECOMMENDED LITHIUM BASED GREASES	3-5
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TOW-BRO[®] CLARIFIER, H-DRIVE

SAFETY PRECAUTIONS

The primary hazards associated with maintaining circular collectors are identified below.

POWER SOURCE LOCK-OUT



Failure to lock out all sources of power during maintenance procedures may result in serious personal injury. Following are the steps of a typical lock-out procedure that can be used by maintenance and repair crews:

1. Alert the operator and supervisor.
2. Identify all sources of residual energy.
3. Before starting work, place padlocks on the switch, lever or valve, locking it in the "off" position, installing tags at such locations to indicate maintenance in progress.
4. Insure that all power sources are off and "bleed off" hydraulic or pneumatic pressure or "bleed off" any electrical current (capacitance), as required, so machine components will not accidentally move.
5. Test operator controls.
6. After maintenance is completed, all machine safeguards that were removed should be replaced, secured and checked to be sure they are functioning properly.
7. Only after ascertaining that the machine is ready to perform safely should padlocks be removed and the machine cleared for operation.

(From Concepts and Techniques of Machine Safeguarding, 1980; U.S. Dept. of Labor OSHA).

TORQUE OVERLOAD CONTROL BOX



Electrical circuits may be energized in the torque overload control box even though the main power is off. Always check for live contacts before making adjustments within the box.

CHAIN GUARDS



Guards cover several points on circular collectors to prevent personal injury from moving parts. If guards must be removed during maintenance procedures, use caution when operating equipment and replace guards when maintenance has been completed.

OPERATING ENVIRONMENT



Circular collectors are usually exposed to the elements. The bridge and other access points may become slippery when wet or icy. Handrails and other safeguards must be in place when working on the equipment. Use care when access is necessary. **Do not work outside of the bridge handrails.** Wipe up grease and oil spills.



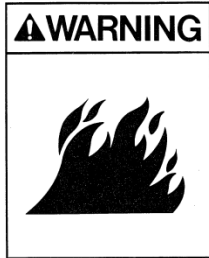
The access area for drive maintenance is below the bridge deck level. The difference in level will depend on the bridge design. A falling hazard exists. Use caution when in or near the access area.

VENTILATION



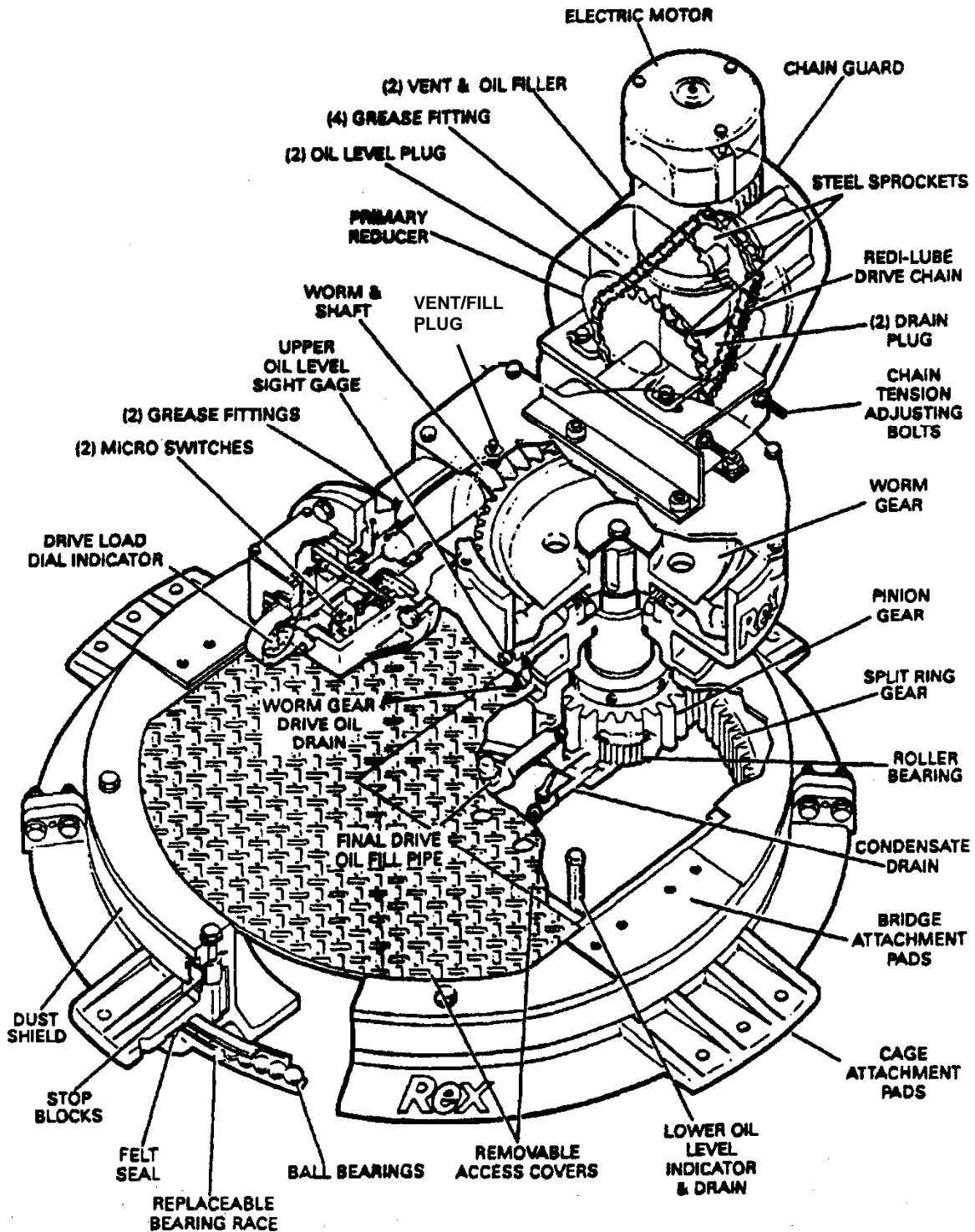
Noxious fumes can be generated by septic sewage. Provide forced ventilation and exhaust facilities when workmen are in a drained tank.

FIRE



Torch cutting, welding and the use of solvents present fire hazards. Use care in these operations and provide fire control equipment in the working area.

NOTE: If field painting or touch-up is required, refer to "Drive Unit Protection for Blast Cleaning" in the INSTALLATION section.



H-DRIVE
Figure 13

GENERAL PRECAUTIONS

To obtain maximum equipment life, it is necessary to perform the preventive maintenance services outlined in this section. Maintenance requirements are a guide for average operating conditions. Conditions, which impose greater wear, loads or strain on the equipment, may dictate increased maintenance. If needed, develop a revised schedule for site-specific requirements. Refer to the manufacturers' bulletins for equipment not manufactured by **Siemens**. These instructions take precedence over those in this manual should any discrepancy be noted.

The maintenance instructions incorporated throughout this manual are meant to be used by qualified service personnel only. Do not attempt to adjust or repair any components without thorough knowledge of this equipment. Read this manual completely. Practice preventive maintenance.

RECOMMENDED LITHIUM BASED GREASES

Any major brand of Lithium based grease No. 2 is recommended unless other lubricants are defined for specific applications in the INSTALLATION or MAINTENANCE sections of this manual.

For vendor-supplied components (i.e. reducer, motor, etc.), see VENDOR INFORMATION section of this manual for suggested lubricant type and frequency.

LUBRICATION SUMMARY

Recommended lubricants for **Siemens** upper housing (worm gear section of main drive) and lower housing (final section of main drive).

SUMMER: 40°F. (4° C.) or higher, Mobil Co. Mobil SHC-630* or equal

WINTER: 40°F. (4° C.) or lower, Mobil Co. Mobil SHC-629** or equal

Recommended lubricants for the primary reducer are in their bulletin in the VENDOR INFORMATION section of this manual.

Siemens Drive Size	Approximate Oil Capacity Upper Housing (Worm Gear)	Approximate Oil Capacity Lower Housing(Final Drive)
H40A LT & HT	5 Quarts (4.7 Liters)	8-1/2 Quarts (8 Liters)

NOTE: Due to the viscosity of the oil, it can take several hours for a true reading to occur at the sight gauge. Overfilling of oil will result in oil leaking into the clarifier.

*Viscosity: 1045/1165 SUS @ 100° F. (38° C.) - ISO Viscosity Grade 220

**Viscosity: 710/790 SUS @ 100° F. (38° C.) - ISO Viscosity Grade 150

ROUTINE MAINTENANCE

ITEM	DESCRIPTION	INTERVAL
SURFACE SKIMMER	Check for smooth action on scum beach and reentry into tank. Check for binding against scum baffle. During winter months, when icing becomes prevalent, place skimmer in lock-out position.	D
	Hose off the skimmer assembly and inspect. Tighten all loose connections; adjust for proper skimmer assembly blade submergence (3" (76mm) below maximum water surface or as indicated on the General Arrangement Drawings). The spring loaded hinged guide should just contact the inner wall of the scum beach.	SA
	Replace any lost or worn parts, such as neoprene wipers, polywear block or springs, if necessary.	SA
WORM GEAR SUBASSEMBLY	Check oil level at sight gauge located on side of worm gear housing	W*
	If low, check for leaking shaft seals at worm shaft near sprockets or remove torque overload housing cover and inspect inside for oil. Replace seals as required. Add oil to proper level. **	
	If high, check for evidence of condensate (water) in oil. Drain small amount of oil from housing and inspect. If clear water is present, drain until oil is draining. Refill to sight gauge with proper grade of oil. ** Check for damaged gasket, air vent, loose or missing cover bolts.	

*Or after severe weather or wash-down procedures.

**Due to the viscosity of the oil, it can take several hours for a true reading to occur at the sight gauge. Overfilling of oil will result in oil leaking into the clarifier.

D - Daily

W - Weekly

M - Monthly

SA - Semi-Annually

MAINTENANCE

ITEM	DESCRIPTION	INTERVAL
WORM GEAR SUBASSEMBLY (Continued)	Inspect and clean, if necessary, worm gear housing air vent.	M
	Grease worm gear bearings with Lithium based #2 grease. Two fittings are located over worm gear on top of housing. Clean fittings; add approximately two pumps from grease gun to each fitting.	M
	Check condition of oil for condensate or other contaminants by draining a small amount, and visual inspection.	M
	If clear water is present, drain until oil becomes present and refill oil to proper level. ** Check for damaged gasket, air vent, loose or missing cover bolts.	
	If oil is milky in color, drain, flush and refill with fresh oil. ** Check for damaged gasket, air vent, loose or missing cover bolts.	
	If metal contaminants are present, remove chain guard, chain, primary gear reducer and worm gear housing cover and inspect for damaged or worn parts. Flush, per procedure at end of this section, and clean housing, replace parts as necessary, reassemble. Add oil to proper level. **	

**Due to the viscosity of the oil, it can take several hours for a true reading to occur at the sight gauge. Overfilling of oil will result in oil leaking into the clarifier.

D - Daily

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SA - Semi-Annually

MAINTENANCE

ITEM	DESCRIPTION	INTERVAL
WORM GEAR SUBASSEMBLY (Continued)	<p>Seasonal change of oil.</p> <p>In preparation for changing the oil, drain out approximately 5% (1 quart [.94 Liters]) and replace with Mobil Oil Corp. Mobil System Cleaner. Run the drive unit at minimum load condition (reduce sludge blanket) for approximately 48 hours. Shut off drive unit and drain. Replace with oil with proper viscosity for anticipated seasonal conditions.</p> <p>**</p> <p>Summer: Mobil SHC-630 Winter: Mobil SHC-629</p> <p>Drain by removing plug in street elbow located in underside of worm gear housing.</p> <p>Air vent/filler plug is located in cover plate.</p>	SA
TORQUE OVERLOAD SWITCHES	<p>Remove cover and inspect inside of housing for signs of condensate or oil.</p> <p>Inspect switches for signs of corrosion. Trip microswitch by placing screw driver in gap to verify alarm/shut-off systems are functional.</p> <p>Review warnings listed on next page.</p>	SA

**Due to the viscosity of the oil, it can take several hours for a true reading to occur at the sight gauge. Overfilling of oil will result in oil leaking into the clarifier.

D - Daily

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ITEM	DESCRIPTION	INTERVAL
TORQUE OVERLOAD SWITCHES (Continued)	DO NOT ADJUST GAPS WITHOUT CONSULTING FACTORY. Gap settings can only be verified after residual load against spring, plate has been neutralized. This can be accomplished by draining the tank and removing any impediments or if draining is not possible, then by removing motor and rotating the input shaft of the primary reducer, releasing tension on drive chain. Continue to rotate input shaft until final gear starts to move opposite of normal rotation. Stop. Further rotation of input shaft will cause damage. Gap settings are indicated on the inside of the torque overload housing cover or on the General Arrangement Specification Drawing. <u>WARNING:</u> DO NOT OPERATE DRIVE IN THE REVERSE ROTATION. Torque overload switches are NOT operative during reverse rotation. Severe damage can occur to mechanism's structure and drive unit. Use reversing switch, if furnished, only for momentary jog to dislodge the rake arm from hang-up or to unload the drive unit.	
DRIVE CHAIN SPROCKETS	Check for loose bolts, setscrews or keys. If necessary, retorque to the correct torque value. Check teeth for wear. Replace when tooth wear presents an observable hooked profile.	M
DRIVE CHAIN	Check chain for excessive slack. Shift primary gear reducer or remove link when required. Check sprocket alignment by placing a straight edge across the machined surfaces of the sprockets. Check chain for wear.	M

D - Daily

W - Weekly

M - Monthly

SA - Semi-Annually

MAINTENANCE

ITEM	DESCRIPTION	INTERVAL
SHEAR PIN SPROCKET	Grease fitting located on hub of shear pin sprocket. Check safety collar. Check for loose setscrews or loose key. Check teeth for wear. Replace when tooth wear presents an observable hooked profile.	M
	Remove chain and shear pin. Rotate hub to expose shear faces. Clean faces and swab with Lithium based #2 grease. Reassemble pin and chain.	SA
	<u>CAUTION:</u> When reinstalling shear pin, necked down portion <u>must</u> be aligned in the shear plane.	
FINAL DRIVE ASSEMBLY	Check oil level at sight gauge located under floor plate cover. Final gear/oil condensate drain is the 1-1/2" (38 mm) ball valve located below sight gauge. Pinion oil/condensate drain is the 3/8" (9.5 mm) ball valve located at the pinion bearing hub. <u>NOTE:</u> Condensate can accumulate at all drain points, therefore, both final gear and pinion drain must be checked.	D*
	If low, check for leaks in oil or condensate drain piping and final drive housing. Add oil to proper level. **	
	If high, check for evidence of condensate (water) in oil. Drain small amount of oil through the oil and condensate drain valves and inspect. If clear water is present, drain until oil is draining. Refill to sight gauge with proper grade of oil. ** Check for loose or damaged dust shield	

*Or after severe weather or wash-down procedures.

**Due to the viscosity of the oil, it can take several hours for a true reading to occur at the sight gauge. Overfilling of oil will result in oil leaking into the clarifier.

D - Daily

W - Weekly

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MAINTENANCE

ITEM	DESCRIPTION	INTERVAL
FINAL DRIVE ASSEMBLY (Continued)	<p>Check condition of oil for condensate or other contaminants by draining a small amount from both oil and condensate drains and visual inspection.</p> <p>If clear water is present, drain until oil becomes present and refill oil to proper level. ** Check for damaged dust shield.</p> <p>If oil is milky in color, drain, flush and refill with fresh oil. ** Check for damaged dust shield.</p> <p>Some metal contaminants (fine particles, visual with the eye) are expected in the first six to twelve months of service due to initial groove formation of bearing races. If contaminants are high in concentration or if large metallic chips are present, take clarifier out of service. After locking out drive starter, inspect stop blocks by pulling back edge of neoprene drive dust seal. If bottoms of stop blocks show signs of contact with the top portion of the main gear or if a stop block is missing, CALL FACTORY</p> <p>Seasonal change of oil.</p>	<p>M*</p> <p>SA</p>

*Or after severe weather or wash-down procedures.

**Due to the viscosity of the oil, it can take several hours for a true reading to occur at the sight gauge. Overfilling of oil will result in oil leaking into the clarifier.

D - Daily

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SA - Semi-Annually

MAINTENANCE

ITEM	DESCRIPTION	INTERVAL
FINAL DRIVE ASSEMBLY (Continued)	<p>In preparation for changing the oil, drain out approximately 5% (1 quart [.94 Liters]) and replace with Mobil Oil Corp. Mobil System Cleaner. Run the drive unit at minimum load condition (reduce sludge blanket) for approximately 48 hours. Shut off drive unit and drain. Replace with oil with proper viscosity for anticipated seasonal conditions.</p> <p>**</p> <p>Summer: Mobil SHC-630 Winter: Mobil SHC-629</p> <p>Drain by opening 1-1/2" (38 mm) ball valve located under floor plate cover. Also, drain each condensate line.</p> <p>Filler plug is located in elbowed pipe located in pinion hub.</p> <p>Check bearing race wear. Every third annual clarifier shut-down, lock out drive starter, inspect final drive by pulling back edge of neoprene drive dust seal to inspect the gap between the stop blocks and the gear. Please refer to "H-Drive Bearing Check Points" page at the end of this section.</p>	Three Years
MOTOR	Refer to manufacturer's bulletins in VENDOR INFORMATION section.	M
PRIMARY REDUCER	Refer to manufacturer's bulletins in VENDOR INFORMATION section	M

**Due to the viscosity of the oil, it can take several hours for a true reading to occur at the sight gauge. Overfilling of oil will result in oil leaking into the clarifier.

D - Daily

W - Weekly

M - Monthly

SA - Semi-Annually

MAINTENANCE

ITEM	DESCRIPTION	INTERVAL
BRIDGE COMPONENTS	<p>Check for and tighten any loose fasteners per the Fastener Installation Instructions of this manual. Special attention should be given to locating loose handrail and/or grating/floor plate connections.</p> <p>NOTE: Inspect and verify bridge base plate expansion connection is free to allow movement for the thermal expansion/contraction of the bridge structure</p>	M
SCUM TROUGH, SCUM BAFFLES, WEIRS	<p>Before tank drain-down, inspect weirs for consistent water depth. Inspect one full rotation of skimmer assembly, checking if any binding occurs. At tank drain-down, hose off all components. Make any necessary adjustments. Replace and tighten any missing or loose bolts. Any mastic sealer or grouting that has cracked or come loose should be replaced.</p>	SA
TOW-BRO UNITUBE HEADER	<p>When tank is drained for semi-annual inspection, remove all slime or sludge with a high pressure hose. Examine all bolted connections for loose or missing bolts or shims. Tighten and replace as necessary.</p> <p>Inspect neoprene fluidizing blade. Replace as necessary.</p> <p>If the clearance between the lip of the unitube header and the floor has changed, we suggest conducting a true plane of rotation check as described in the INSTALLATION section of the manual. If out of plane, CALL FACTORY</p>	SA

D - Daily

W - Weekly

M - Monthly

SA - Semi-Annually

MAINTENANCE

ITEM	DESCRIPTION	INTERVAL
MANIFOLD SEALS	Hose off manifold seals and verify they are making full contact with the sealing surfaces as the mechanism revolves the full 360°. Replace seals when the material becomes cracked or brittle.	SA
OIL FLUSHING PROCEDURE FOR SIEMENS INTERMEDIATE AND FINAL HOUSING ONLY	Reduce loading on clarifier mechanism by lowering sludge blanket as a minimum; it is preferred to drain and clean tank. Stop and lock out drive motor. Drain existing oil. Refill with a mixture of 50% Mobil Oil Corp. Mobil System Cleaner and 50% of any gear lube oil. Run unit for 4 hours. Stop and drain. Refill with proper viscosity oil for anticipated weather.** For other gear reducers, see manufacturer's bulletins in VENDOR INFORMATION section.	AS NEEDED

**Due to the viscosity of the oil, it can take several hours for a true reading to occur at the sight gauge. Overfilling of oil will result in oil leaking into the clarifier.

D - Daily

W - Weekly

M - Monthly

SA - Semi-Annually

TROUBLESHOOTING GUIDE

<u>PROBLEM</u>	<u>POSSIBLE CAUSE</u>	<u>CORRECTIVE ACTION</u>
DRIVE OVERHEATING	Oil level too low.	Fill to correct level.
	Oil level too high	Check for condensation or water present in oil reservoirs.
	Low oil level in high speed gear case.	Fill to proper level
BROKEN SHEAR PINS OR ALARM BEING SET OFF	Solids build-up in tank.	Drain tank and clean.
	Large debris in tank	Drain tank and remove.
	Grout on tank floor raised	Drain tank, repair floor and re-grout.
	Damaged/missing stop blocks.	Refer to H-Drive Bearing Check Point sheet.
	Scraper making contact with tank floor.	Drain tank and adjust properly. Check for proper rotation of scraper for correct clearance.
SKIMMER NOT SKIMMING PROPERLY	Bridge being locked down.	Loosen and check expansion slots for movement.
	Blade not adjusted correctly.	Adjust blade so it makes full contact with beach.
	Build-up of material on beach.	Clean and remove fibrous material.

MAINTENANCE

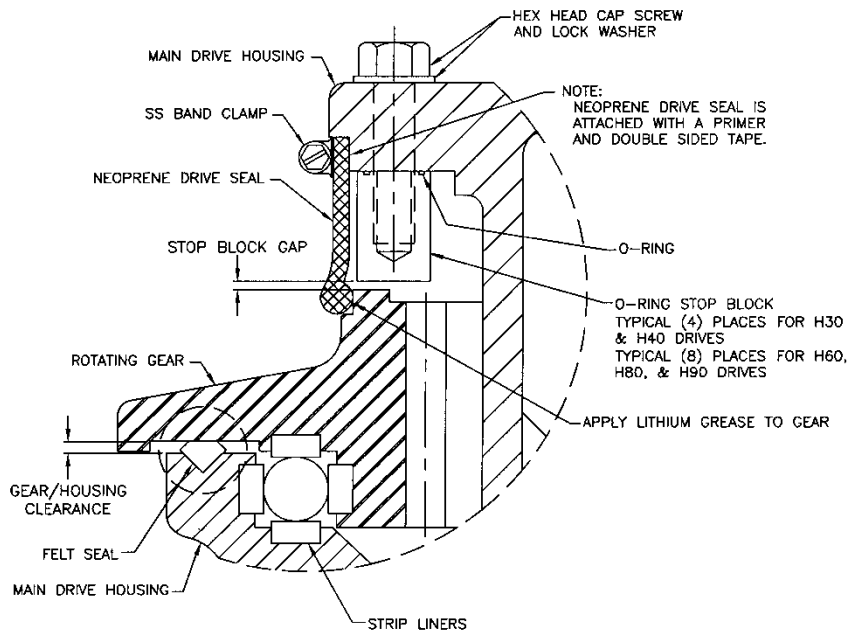
<u>PROBLEM</u>	<u>POSSIBLE CAUSE</u>	<u>CORRECTIVE ACTION</u>
HIGH SLUDGE BUILD-UP	Header tube or sludge pit clogged.	Drain and clean.
LOW CONCENTRATION OF SOLIDS, LOWER THAN NORMAL	Bad manifold seals.	Drain and replace seals.

H-DRIVE BEARING CHECK POINTS

DRIVE	BALL DIAMETER	STOP BLOCK GAP	MAXIMUM STOP BLOCK GAP	GEAR / HOUSING CLEARANCE
H40A, H40HD	1.00" 25.4 mm	0.07" 1.778 mm	0.31" 7.874 mm	0.25" 6.25 mm

NOTES:

1. When stop block gap approaches 0.200" (5.08 mm), replacement of strip liners is suggested.
2. If stop block gap reaches the maximum allowable gap indicated, drive rebuild is recommended.
3. If top of main gear and underside of stop blocks are scored or worn, a detailed inspection of the drive/mechanism by a **Siemens** Field Technician is recommended.
4. If a stop block is missing, STOP the drive immediately, and contact sales representative or **Siemens** Field Service Manager.



SECTION 4 CONTENTS

ITEM	PAGE
SAFETY PRECAUTIONS	4-1
GENERAL OVERHAUL PRECAUTIONS	4-1
OVERHAULING THE DRIVE	4-2
ROTATING EQUIPMENT ALIGNMENT	4-5
RECOMMENDED SPARE PARTS	4-6

TOW-BRO® CLARIFIER, H-DRIVE

SAFETY PRECAUTIONS

The safety precautions, which apply to overhaul procedures, are the same as those involved in installing, operating and maintaining circular clarifiers. No overhaul procedure should begin before the safety precautions in the GENERAL INFORMATION section and those precautions listed at the beginning of the INSTALLATION, OPERATION and MAINTENANCE sections of this manual have been carefully reviewed.

GENERAL OVERHAUL PRECAUTIONS

1. Drain the tank or well, hose down the equipment and the tank so that noxious fumes are at a minimum and surfaces afford good footing.
2. Have a small crane or portable hoist available. Many components are heavy and some procedures require lifting before timber supports are placed.
3. Use cable in first class condition when parts are to be lifted.
4. Provide a dry area for storing parts prior to reassembly.
5. Have this Service Manual available to you. Refer to the General Arrangement and Assembly Drawings for locating dimensions when questions arise. Included in the manual are other manufacturers' maintenance guides and re-lubrication instructions.
6. **Siemens** equipment, other than motor reducers and electrical components, do not require special tools for disassembly. Care must be taken, however, when removing cast iron or semi-steel sprockets and bearings or set collars. Clean up shafts before attempting to slide sprockets, bearings or set collars off the shafts. Use rust solvents to loosen setscrews. Use a solvent like Toluol to dissolve bitumastic coatings.
Provide adequate ventilation.
7. Take care when burning off nuts or bolt heads that adjacent accumulations of oil, grease or paint do not start to burn. **Have fire control equipment handy.**
8. If it is necessary to use a torch to help remove a sprocket, do not attempt to burn completely through the hub. Burn a groove into the hub and use chisels to split the hub.

9. Be sure to use a proper ground when doing any welding so that arcing across any bearing in adjacent machinery is avoided. Be especially careful when welding near motors and reducers.
10. Grind all welds smooth in areas where some other part has to cross the weld.
11. Use the Fastener Installation Instructions furnished when reassembling structural components. Refer to the separate motor and reducer manufacturers' bulletins for reassembly instructions concerning torque values.

OVERHAULING THE DRIVE

We suggest the services of a **Siemens** Service and Erection Technician, if a complete overhaul of your drive is proposed. However, the following instructions will enable qualified on-site maintenance personnel to overhaul the final drive.

Before disassembly of any equipment, refer to the pocket in this manual for the drawings, which can serve as a guide during overhaul.

The drive is designed so that most of the overhaul is possible without removing the bridge. However, it will be necessary to drain the tank and hose down the submerged equipment. Rotating machinery (center cage, truss header, etc.) must be blocked securely and safely in place before the bolts that hold the cage to the final drive can be removed. It is only necessary to remove the bridge if the housing of the final drive is to be removed from the center pier.



**DO NOT begin overhaul without first disconnecting the power.
See the procedure on Page 3-1.**

1. Disconnect and lock out the drive electrically.
2. Drain the final drive. We recommend that the primary and secondary worm gear drives be removed, drained, flushed and re-lubricated at this time.
3. Block the truss arms and the cage in place on the tank floor using wooden blocks and hydraulic jacks or screw jack.

4. Secure the upper center cage to the center support pier with "come-alongs".
5. Using a chain hoist, remove the intermediate worm gear housing and primary motor/reducer assemblies. There are eight (8) bolts connecting the worm gear housing to the final drive housing.

When removing the pinion shaft assembly, the outer race of the lower pinion bearing will stay in the housing, as this is a "press fit". A puller will need to be used to remove this outer race, if necessary. Use caution when installing a new race to insure no damage occurs.

6. Remove the dust shield from the outer periphery of the final gear. This will expose the stop blocks.
7. Remove the stop block capscrews and round stop blocks.
8. Remove the bolts connecting the drive attachment pads to the upper cage.
9. The main gear is split. Secure each gear half from dropping before removing the hardware at the gear splice.
10. Remove the capscrews and tapered pins joining the final gear halves at the connecting flanges, then lift and remove the halves. The internal gear halves are heavy and will require block and tackle or small hoist to lift them up and over the handrail. The 38" (965 mm) diameter final gear assembly weighs approximately 400 pounds (180 Kg), with each gear half weighing 200 pounds (90.8 Kg). A temporary wood plank platform mounted on the cage or walkway can provide additional work space.
11. Remove the existing ball bearings, races and felt seal strip from the housing. Thoroughly clean the housing, gear halves, bearings and races with a good commercial solvent. If races cannot be pried out, drill a small hole through the drive casting and punch from behind. Tap and plug hole before reassembly.
12. Examine and count the ball bearings and check the bearings and races for galling, pitting or any other roughness. Replace as needed.
13. Check the condition of the interior of the housing for rust and loose paint. If needed, scrape out and repaint non-machined surfaces.
14. Thoroughly clean the sump of the lower pinion shaft bearing driven by the intermediate worm gear.

15. Remove the existing races from the final gear halves; clean the housing, gear and other components as much as possible.

ASSEMBLY PROCEDURE

16. Stake the new ball races in place. Lay out each set of four (4) races: upper, lower, inner and outer. Trimming is necessary to remove flat ends or for proper length. Note: Ball races are hardened and if excessive saw speed is used, the race could overheat and lose its temper. Care should be taken.

Races can be individually fit with the gear halves turned upside down. The gear holds the inner and upper races. The main housing holds the lower and outer races. Position the races with "C" clamps, butt races tight to each other and peen at main gear or housing as necessary to keep races in place during reinstallation of the gear.

17. If the lower pinion bearing is replaced, the outer race of this bearing must be press fit into the lower cast iron housing before installing the pinion shaft assembly. Use caution to avoid damage when installing the shaft assembly.
18. Using Permatex or equal, cement a new felt strip in the housing "V" groove. Cut splices at 45° with top of splice pointing in direction of rotation.
19. Install the ball bearings in the housing, setting them in beads of grease to hold them in position until the gear halves are reinstalled. Recount the balls to be sure all are reinstalled.
20. Reinstall the gear halves, reversing the procedure used in disassembly. Use care when setting the halves in position so as not to upset the ball bearings or newly installed felt seal.
21. Bolt up the gear halves finger-tight, then drive the taper pins into the flanges of the gear halves.
22. Torque bolts per SAE Grade 5.
23. Reinstall the stop blocks and check for clearance between the stop block and the gear.
24. Attach the dust shield.

The instructions for installing the neoprene dust seal to the main drive housing can be found on the "Turntable Subassembly" drawing included with this manual. Follow all instructions carefully. If parts of the dust shield are worn or missing refer to the contact list at the front of the manual to order replacements through the **Siemens** Parts Dept. Apply grease to the contact area between the bottom of the dust shield and the top of the rotating gear per the instructions on the drawing before starting the drive.

25. Replace any drain plugs that were removed and fill with proper lubricant to operating level.
26. Reconnect the final drive to the rotating cage. Remove support blocks and jacks. Set secondary worm gear drive and reconnect to electrical service. Recheck the alarm and shut off microswitch settings for proper gap. Realign for horizontal plane per **Siemens** service manual.

ROTATING EQUIPMENT ALIGNMENT

After overhauling the final drive, the rotating equipment will need to be reconnected to the drive. The equipment will have to be realigned in the same manner as when it was installed. Refer to the INSTALLATION section of this manual for these procedures.

RECOMMENDED SPARE PARTS

PART NAME	QUANTITY REQUIRED	
	DOMESTIC – ONE TO THREE UNITS	DOMESTIC – MORE THAN THREE OR OVERSEAS
Shear Pins	Twelve	Twenty-Four

Note: **Siemens** does not recommend purchasing lists of spare parts. At the time a spare is needed it may have deteriorated from aging or improper storage. If spare parts are required, refer to the contact list at the front of this manual and call the **Siemens** Parts Department.

SECTION 5 CONTENTS

REDUCER

MOTOR



EXTENDED STORAGE



This unit has been prepared for extended storage.

Store this unit in a protected, dry, vibration free area per SEW-Eurodrive Gear Unit Operating Instructions.

Follow instructions on the back of this label before placing the unit into service.

Commissioning the Unit

These steps **MUST** be followed before operation:

Verify that the gear unit oil level is proper for the mounting position required. This *may* require draining excess oil from the gear unit in some instances. Refer to SEW-Eurodrive Gear Unit Operating Instructions.

Remove corrosion inhibitor on exposed shafts and/or flange surfaces with mineral spirits.

Ensure gear unit vent plug is installed in the proper location for the mounting position and the rubber seal is removed.



Review the Gear Unit and/or Motor Operating Instructions from SEW-Eurodrive for additional installation and startup instructions.

Contact the nearest SEW-Eurodrive facility if you have any questions.

Midwest	West	Southeast	Southwest	East
2001 West Main St. Troy, OH 45373 937-335-0036 937-440-3799 (fax)	30599 San Antonio Rd. Hayward, CA 94544 510-487-3560 510-487-6381 (fax)	1295 Old Spartanburg Hwy. Lyman, SC 29365 864-439-7537 864-439-0566 (fax)	3950 Platinum Way Dallas, TX 75237 214-330-4824 214-333-4198 (fax)	2107 High Hill Rd. Bridgeport, NJ 08014 856-467-2277 856-845-3179 (fax)

Technical Note

Long-Term Storage

SEW supplies all 7-series (R, S, K, F, W) gear reducers and gearmotors with oil. The quantity of oil depends upon the mounting position as stated on the reducer nameplate. Since most mounting positions do not require the reducer to be completely filled with oil, the reducer usually contains a cavity of air. After prolonged inactivity, the air can become moist, resulting in damage. For example, rust may develop on the bearings, gears, and other steel components that are not submersed in oil. In addition, flat spots may develop on the balls of the bearings or bearing raceway (brinelling) due to a concentrated load at a single point. Such loads exist on bearings that support the heavy rotors of large motors or on bearings that support the shaft of a bevel gear set, since the bevel set is preloaded upon installation.

To avoid potential problems during an extended rest, SEW offers the “Long Term Storage” option containing the following specifications.

Reducer

- Regardless of mounting position, reducer is completely filled with the type of oil requested by the customer. No additional products are mixed into the oil.
- Oil level plug is installed at the normal location for the nameplate mounting position.
- Breather plug is installed in the normal location for the nameplate mounting position.
- Reducer contains finish paint and rust-inhibiting primer paint.
- All unpainted exterior surfaces, such as input shaft, output shaft, and flange face are coated with cosmoline, a removable rust-inhibiting film.
- A “Long Term Storage” tag is attached to the eyebolt.

Varimot® or Varigear® Mechanical Variable Speed

- Varimot® contains a chrome-plated driving disc.
- Varigear® contains nitrided pulleys.
- Contains finish paint and rust-inhibiting primer paint.
- All unpainted exterior surfaces, such as input shaft, output shaft, and flange face are coated with cosmoline, a removable rust-inhibiting film.
- When a reducer is not supplied, a “Long Term Storage” tag is attached to an eyebolt on the Varimot or Varigear.

Technical Note

~~Motor~~

- ~~• Contains an insulation coating on the stator windings.~~
- ~~• Contains finish paint and rust-inhibiting primer paint.~~
- ~~• Motor shaft extension, if applicable, is coated with cosmoline, a removable rust-inhibiting film.~~
- ~~• Motor does not contain drain holes. If drain holes are required, request the Severe Duty option along with Long Term Storage.~~

~ Important! ~

The output shaft of a gearmotor, motor, Varimot or Varigear containing long-term storage should be manually rotated every 2–3 months to prevent the bearings from brinnelling. In addition, the unit should be stored in a protected area that is not subject to vibration.

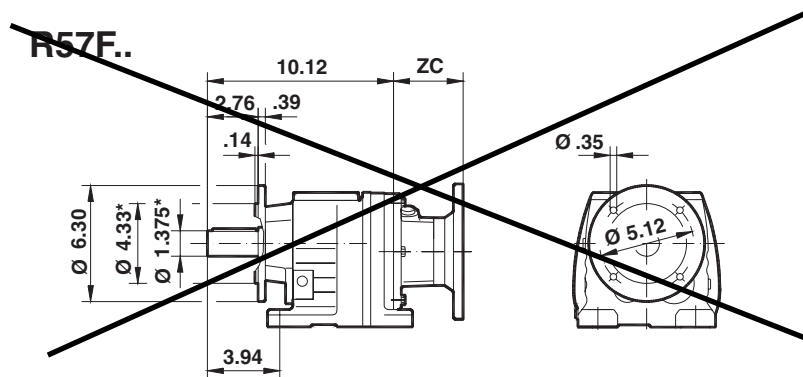
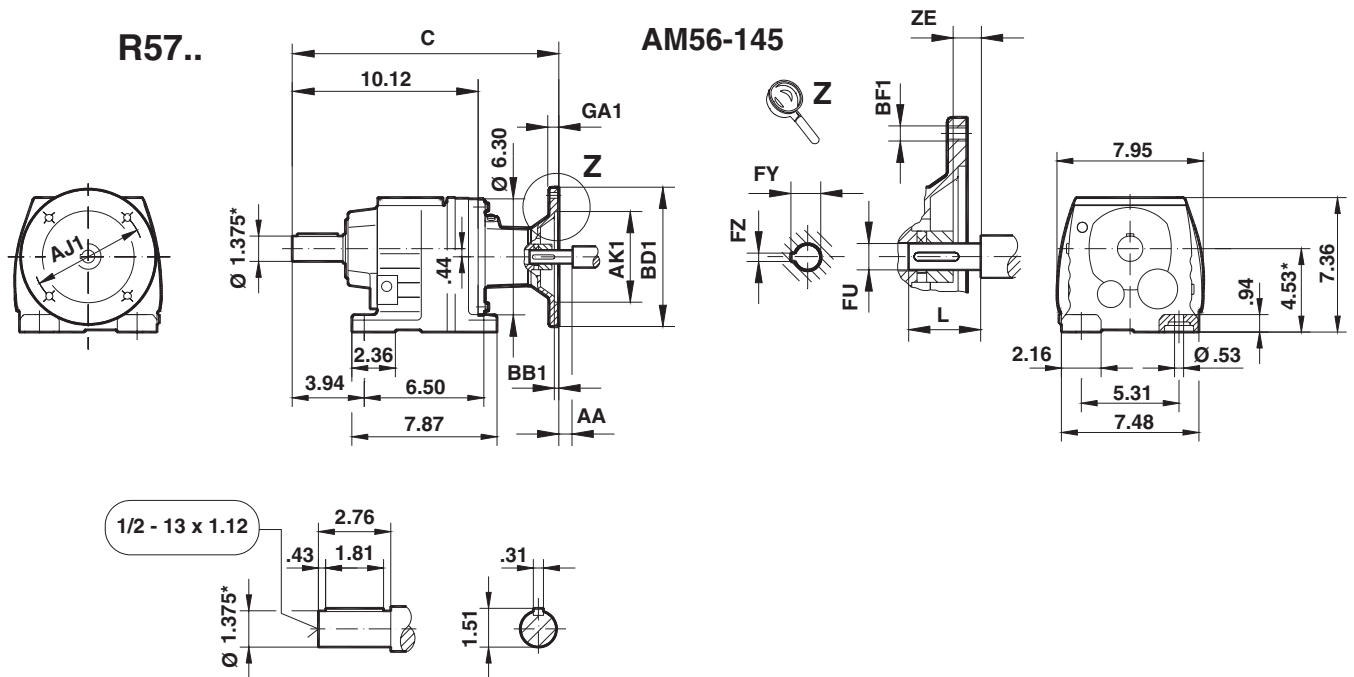
Placing Stored Units in Service:

When placing the unit in service, perform the following steps.

1. Remove the waxy cosmoline film on the output shaft, input shaft, and flange face with a cleaning agent.
2. Remove the oil drain plug.
3. Drain the excess oil from the reducer.
4. Reinstall oil drain plug.
5. ~~Inspect the motor for accumulation of condensation. Refer to the procedure described in the “Motors and Brakemotors Operating Instructions” that are sent with the drive. Additional copies of the instructions are available for download from the Technical Information section of the SEW website: www.seweurodrive.com.~~

If the actual mounting position is different than the mounting position stated on the nameplate, contact SEW. A new mounting position requires a different oil level and a new nameplate for future reference.

No other steps are necessary before placing long-term storage units into service.



		AK1	GA1	AJ1	BB1	BD1	C	AA	BF1	ZC	ZE	FU	L	FY	FZ
R57 R57F	AM56	4.50	0.43	5.875	0.18	6.69	13.55	-0.19	0.41	3.43	0.65	0.625	1.85	0.71	0.188
	AM143	4.50	0.47	5.875	0.18	6.69	14.47	0.12	0.41	4.33	0.37	0.875	2.24	0.98	0.188
	AM145	4.50	0.47	5.875	0.18	6.69	14.47	0.12	0.41	4.33	0.37	0.875	2.24	0.98	0.188

***Refer to page 101 for tolerance information**
Dimensions subject to change without notice

Refer to page 94 for Alternate Shifts
See page 99 for Compound Reducer Information

Parts List

Helical gear unit
R57

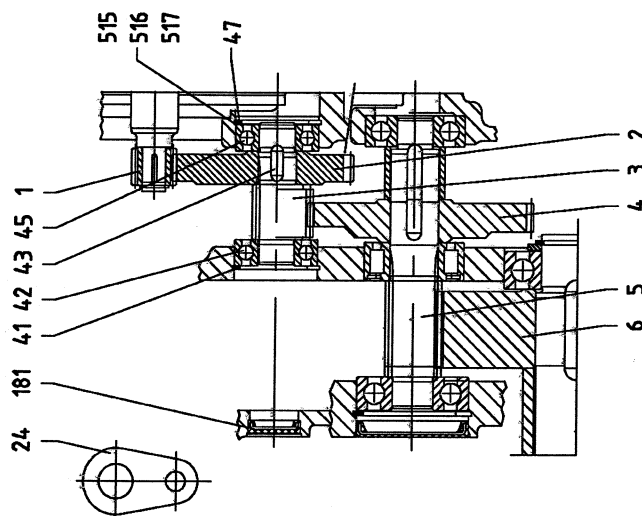
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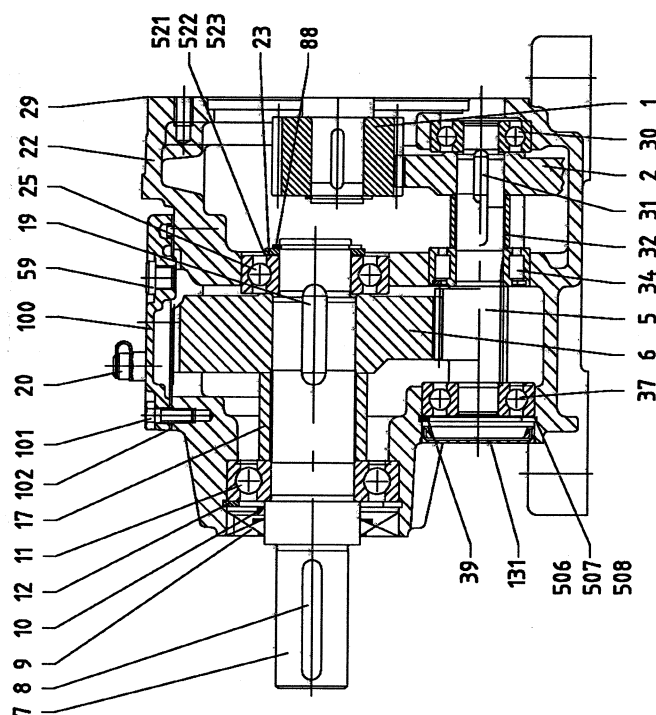
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3-stage



2-stage



When ordering spare parts always quote nameplate data with serial number and designation with part number!
Mount-on gear units have motors, variable speed gear units or special input shaft assemblies mounted on the drive end. For parts see appropriate parts list.

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Parts List

Helical gear unit
R57

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No.	Description	Additional specifications	SEW standard label	Part No.	Qty.
1	Pinion			*	1
2	Gear			*	1
3	Pinion shaft			*	1
4	Gear			*	1
5	Pinion shaft			*	1
6	Gear			*	1
7	Output shaft		Ø 35x70 mm	06413447	1
7	Output shaft	stainless; ASEPTICplus	Ø 35x70 mm	00452564	1
7	Output Shaft (inch)		Ø 1,375x2,76 in.	06413455	1
8	Key		DIN6885 A10x8x56-C45K	00100293	1
8	Key	stainless; ASEPTICplus	DIN6885 A10x8x56-Niro	13228218	1
8	Key (inch)		W4190 5/16x5/16x1-13/16 IN.	08069239	1
9	Oil seal		W4560 BA-SF40x72x10/6-NBR	0017758X	1
9	Oil seal	optional oil seal in FKM (Viton); ATEX model according to category II2G, II2D, II3G, II3D; ASEPTICplus	W4561 BA-SF40x72x10/6-FKM	00176133	1
10	Oil seal	Double sealing; ATEX model according to category II2G, II2D, II3G, II3D; ASEPTICplus	W4562 B1-SF 40x66x8/10-FKM	00174343	1
11	Deep groove ball bearing		DIN625 6207-Z-J	00112879	1
12	Circlip		DIN472 72x2,5	00103225	1
17	Spacer tube		Ø36xØ45x36,5 mm	06413463	1
19	Key		DIN6885 B10x8x32-55HRC	00100579	1
20	Breather valve		W4087 M10x1-MS	00130303	1
20	Breather valve	stainless; ASEPTICplus	W4087 M10x1-NIRO	00136239	1
22	Gear Housing			06413412	1
23	Supporting disc		DIN988 S30x42x2,5-FST	00103489	1
24	Eyebolt			01644122	1
25	Deep groove ball bearing		DIN625 6206-J	00104892	1
29	Sealing compound			09102558	X)
30	Deep groove ball bearing		DIN625 6302-J	00105066	1
31	Key	2-stage	DIN6885 B6x6x16-55HRC	00116017	1
31	Key	3-stage	DIN6885 B6x6x14-55HRC	00116149	1
32	Spacer tube		Ø20,6xØ25x22 mm	06433421	1
34	Cylindrical roller bearing		F55357501.01 NUPT INA	13241281	1
37	Deep groove ball bearing		DIN625 6303-J	00105074	1
37	Deep groove ball bearing	Only for mounting positions M2, MX	DIN625 6303-Z-J	00105201	1
39	Circlip		DIN472 47x1,75	00103187	1
41	Circlip		DIN472 35x1,5	00103144	1
42	Deep groove ball bearing		DIN625 6202-J	0010485X	1
43	Key		DIN6885 B5x5x10-55HRC	00114839	1
45	Deep groove ball bearing		DIN625 6202-J	0010485X	1
47	Circlip		DIN472 35x1,5	00103144	1
59	Screw plug		W4085 M10x1-ST-A2L	0011426X	5
88	Circlip		DIN471 30x1,5	00102776	1
100	Gearcase cover			06432093	1
101	Hex head screw		ISO4017 M6x16-8.8	00101052	6
102	Gasket			06435041	1
131	Closing cap		W4300 47x7	00124974	1
181	Closing cap		W4300 37x10	00106895	1
506	Shim		DIN988 37x47x0,1-ST	0010373X	X)
507	Shim		DIN988 37x47x0,3-ST	00103977	X)
508	Shim		DIN988 37x47x0,5-ST	00123404	X)

* Gearing parts have embossed part numbers. These must always be quoted!

X) if required

When ordering spare parts always quote nameplate data with serial number and designation with part number!

Mount-on gear units have motors, variable speed gear units or special input shaft assemblies mounted on the drive end. For parts see appropriate parts list.

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Parts List

Helical gear unit
R57

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No.	Description	Additional specifications	SEW standard label	Part No.	Qty.
515	Shim		DIN988 25x35x0,1-ST	00103691	X)
516	Shim		DIN988 25x35x0,3-ST	00103934	X)
517	Shim		DIN988 25x35x0,5-ST	00104167	X)
521	Shim		DIN988 30x42x0,1-ST	00103853	X)
522	Shim		DIN988 30x42x0,3-ST	00104094	X)
523	Shim		DIN988 30x42x0,5-ST	00123455	X)

X) if required

When ordering spare parts always quote nameplate data with serial number and designation with part number!

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Parts List

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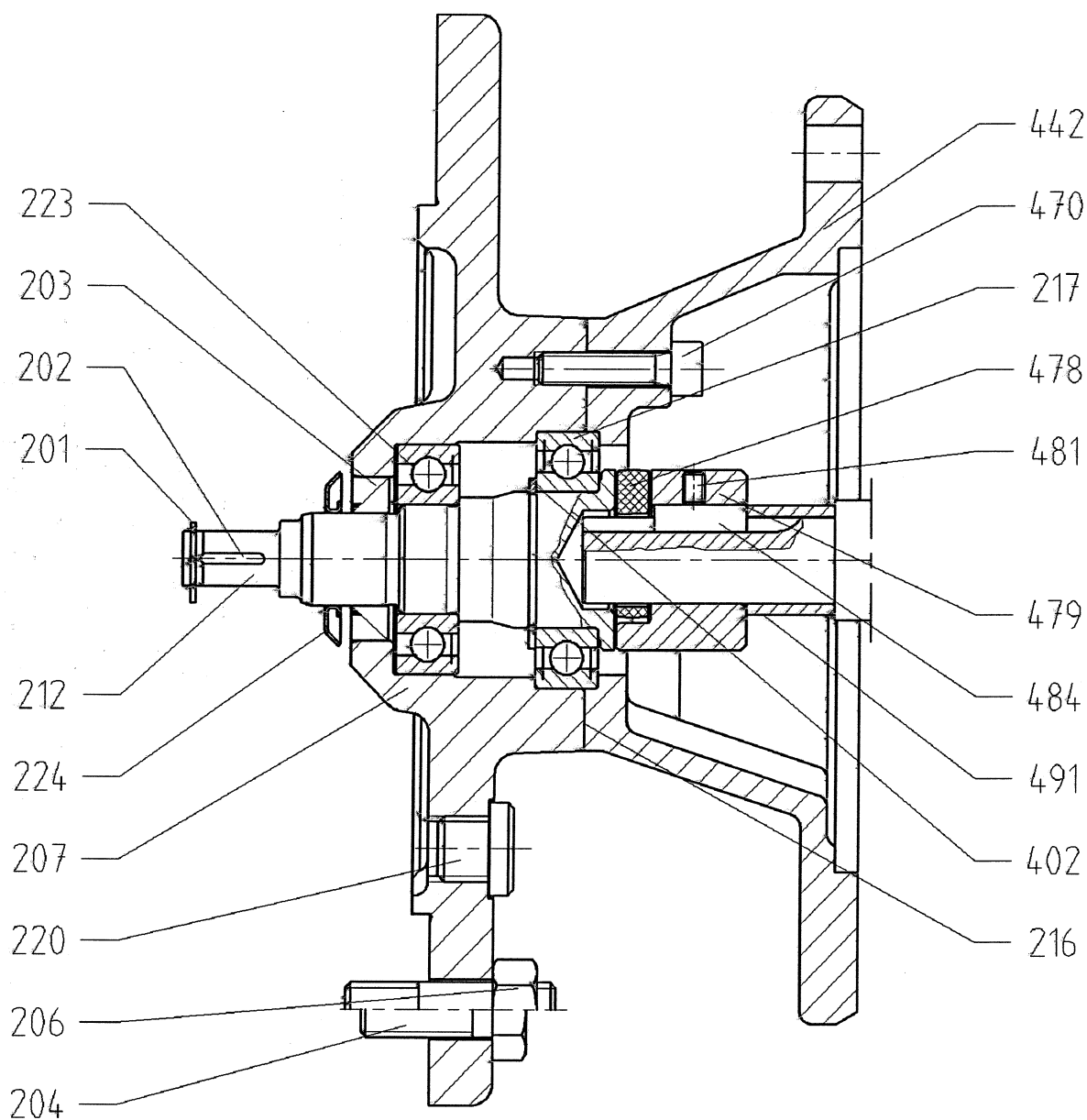
Adapter

AM56

for mounting NEMA motors version with dog clutch

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EG 22.07.2010



When ordering spare parts always quote nameplate data with serial number and designation with part number!

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Parts List

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Adapter

AM56

for mounting NEMA motors version with dog clutch

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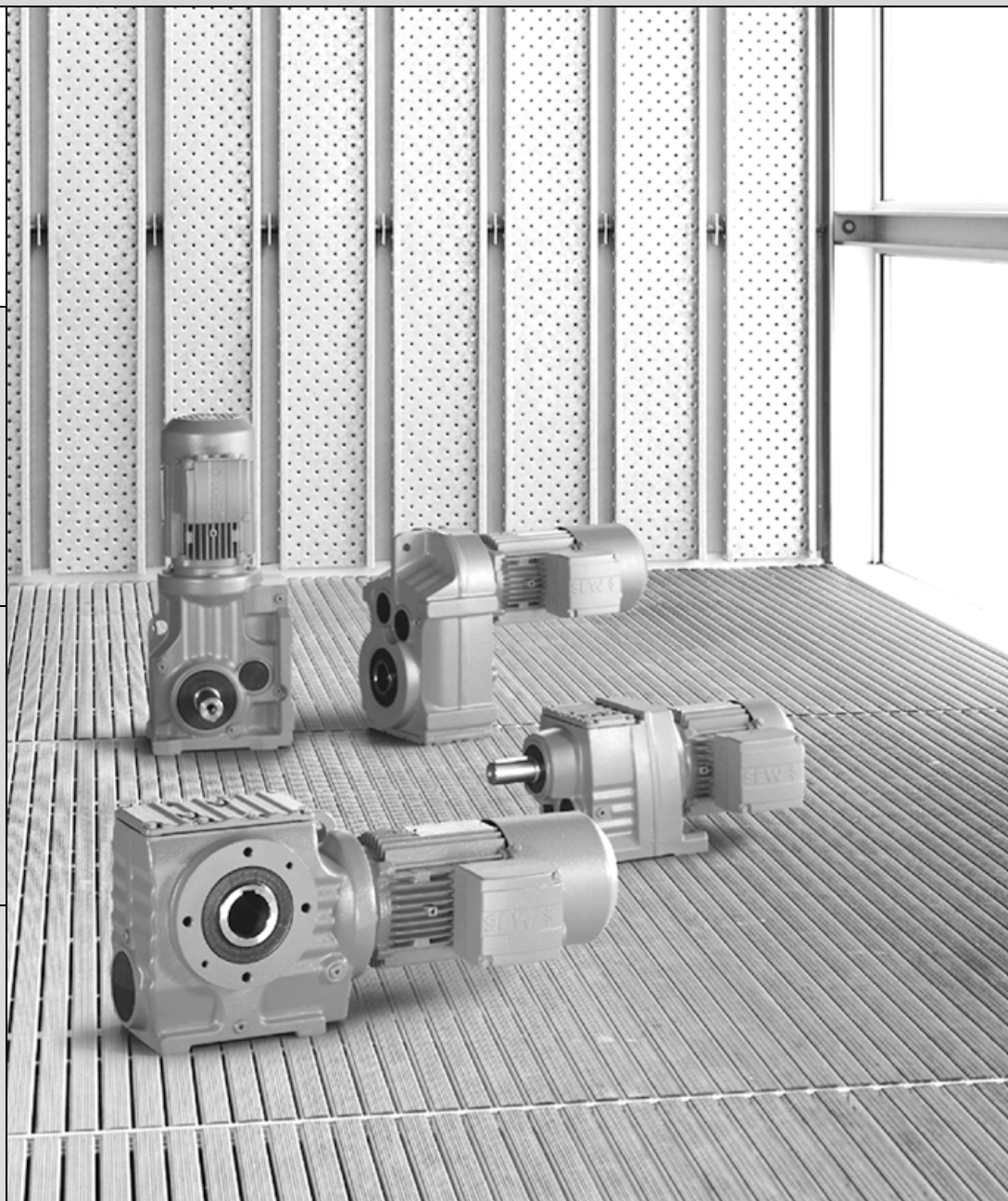
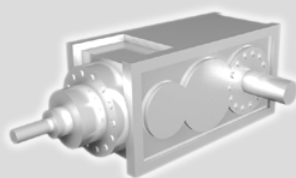
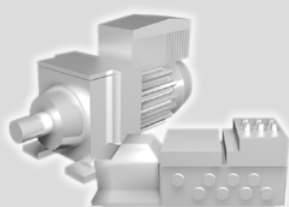
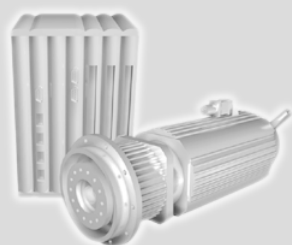
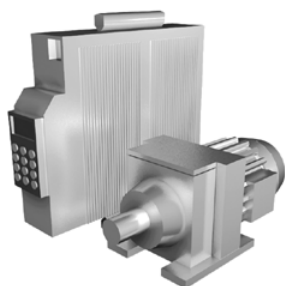
No.	Description	Additional specifications	SEW standard label	Part No.	Qty.
201	Snap ring		W4173 SW10x1	00115193	1
202	Key		DIN6885 A2x2x12-C45K	00100005	1
203	Oil seal		W4266-A17x30x7-NBR	00106062	1
203	Oil seal	optional oil seal in FKM (Viton); ATEX model according to category II2GD	W4270-A17x30x7-FKM	00115584	1
204	Stud	mounting to R27;F27	W4061 M6x16-8.8	00131687	4
204	Stud	for flange Ø120	DIN939 M6x18-8.8-A2F	00134074	4
204	Stud	for flange Ø160	DIN939 M8x25-8.8-A2F	13303481	4
204	Hex head screw	for flange Ø200	ISO4017 M10x25-8.8	00101168	4
206	Hexagon nut	for flange Ø120	ISO4032 M6-8	00101982	4
206	Hexagon nut	for flange Ø160	ISO4032 M8-8-St-A2F	00101990	4
207	Flange		Ø120mm	01651269	1
207	Flange		Ø160mm	01651285	1
207	Flange		Ø200mm	01651307	1
212	Adapter Shaft	pinion shaft end Ø10		01657097	1
216	Sealing compound			09102558	X)
217	Deep groove ball bearing		DIN625 6005-2Z-K3K-20	00170860	1
217	Deep groove ball bearing	ATEX model according to category II2GD	DIN625 6005-2Z-J-K2-N-40	13224018	1
220	Screw plug	for flange Ø120-Ø160	W4085 M10x1-ST-A2L	0011426X	1
220	Breather valve	for flange Ø120-Ø160	W4087 M10x1-CuZn	00130303	1
220	Screw plug	for flange Ø200	W4085 M12x1,5-ST-A2L	00114308	1
220	Breather valve	for flange Ø200	W4087 M12x1,5-CuZn	00130311	1
223	Deep groove ball bearing		DIN625 6004-Z	00117447	1
224	Oel finger		W4291 17-ST-ZN	00116602	1
402	Circlip		DIN471 25x1,2	00102741	1
442	Adapter flange			01651846	1
470	Machine screw		ISO4762 M6x25-8.8	00101346	4
478	Cam Ring			01657291	1
479	Coupling half A	Ø0,625"		01657445	1
481	Setscrew		DIN914 M4x6-45H	00104574	1
484	Key (inch)		W4190 3/16x3/16x9/16IN.	0806993X	1
491	Spacer tube			01655450	1

X) if required

When ordering spare parts always quote nameplate data with serial number and designation with part number!

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SEW-EURODRIVE GmbH & Co KG Postfach 3023, D-76642 Bruchsal Tel. (07251) 75-0. Fax (07251) 75-1970. <http://www.sew.de>



Gear Units, R..7, F..7, K..7, S..7 Series, SPIROPLAN® W

Edition 10/2007

11226811 / US

Operating Instructions



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Note: This is an abbreviated version of the manual relating to the items furnished on this order. The complete manual may be retrieved online at www.seweurodrive.com.



1 Important Notes

Safety and warning instructions

Always follow the safety and warning instructions in this publication!



Electrical hazard

Possible consequences: Severe or fatal injuries.



Hazard

Possible consequences: Severe or fatal injuries.



Hazardous situation

Possible consequences: Slight or minor injuries.



Harmful situation

Possible consequences: Damage to the drive and the environment.



Tips and useful information.



You must adhere to the operating instructions to ensure:

- Trouble-free operation
- Fulfillment of any rights to claim under guarantee

Consequently, read the operating instructions before you start working with the gear unit!

The operating instructions contain important information about servicing. Therefore, keep the operating instructions close to the gear unit.



- Adjust the lubricant fill volume and position of the breather valve accordingly in the event of a change of mounting position (see Sec. "Lubricants" and "Mounting Positions").
- Follow the instructions in Sec. "Mechanical installation" / "Installing the gear unit"!



2 Safety Notes

Preface

The following safety notes are primarily concerned with the use of gear units. If using **garmotors**, please also refer to the safety notes for motors in the relevant operating instructions.

Please also consider the supplementary safety notes in the individual sections of these operating instructions.

General information

During and after operation, garmotors, gear units and motors have:

- Live parts
- Moving parts
- Hot surfaces (may be the case)

Only qualified personnel may carry out the following work:

- Transportation
- Putting into storage
- Installation / assembly
- Connection
- Startup
- Maintenance
- Servicing

The following information and documents must be observed during these processes:

- Relevant operating instructions and wiring diagrams
- Warning and safety signs on the gear unit / garmotor
- System-specific regulations and requirements
- National / regional regulations governing safety and the prevention of accidents

Serious injuries and property damage may result from:

- Improper use
- Incorrect installation or operation
- Unauthorized removal of necessary protection covers or the housing

Designated use

Garmotors / gear units from SEW are intended for industrial systems. They correspond to the applicable standards and regulations.

Technical data and information about the permitted conditions can be found on the nameplate and in the documentation.

It is essential that you follow all the instructions!



Transportation

Inspect the shipment for any damage that may have occurred in transit as soon as you receive the delivery. Inform the shipping company immediately. It may be that you are not permitted to startup the drive due to the damage.

Tighten installed eyebolts. The eyebolts are only designed for the weight of the gearmotor / gear unit. Do not attach any additional loads.

The installed lifting eyebolts comply with DIN 580. The loads and regulations specified in this standard must always be observed. If two eyebolts are available, use both of them for transport. In this case, the tension force vector of the slings must not exceed a 45° angle in accordance with DIN 580.

Use suitable, sufficiently rated handling equipment if necessary. Remove any transportation fixtures prior to startup.

Extended storage of gear units

Gear units of the "extended storage" type have:

- An oil fill suitable for the mounting position so the unit is ready to run (mineral oil CLP and synthetic oil CLP HC). You should still check the oil level before startup (see Sec. "Inspection / Maintenance" / "Inspection and maintenance of the gear unit").
- A higher oil level in some cases (synthetic oil CLP PG / food grade oil). Correct the oil level before startup (see Sec. "Inspection / Maintenance" / "Inspection and maintenance of the gear unit").

Comply with the storage conditions specified in the following table for extended storage:

Climate zone	Packaging ¹⁾	Storage location	Storage time
Temperate (Europe, USA, Canada, China and Russia, excluding tropical zones)	Packed in containers, with desiccant and moisture indicator sealed in the plastic wrap.	With roof, protected against rain and snow, no shock loads.	Up to three years with regular checks on the packaging and moisture indicator (relative atmospheric humidity < 50 %).
	Open	With roof, enclosed at constant temperature and atmospheric humidity (5 °C < 9 < 60 °C, < 50 % relative atmospheric humidity). No sudden temperature fluctuations and controlled ventilation with filter (free from dirt and dust). No aggressive vapors and no shock loads.	Two years or more given regular inspections. Check for cleanliness and mechanical damage as part of the inspection. Check corrosion protection.
Tropical (Asia, Africa, Central and South America, Australia, New Zealand excluding temperate zones)	Packed in containers, with desiccant and moisture indicator sealed in the plastic wrap. Protected against insect damage and mildew by chemical treatment.	With roof, protected against rain, no shock loads.	Up to three years with regular checks on the packaging and moisture indicator (relative atmospheric humidity < 50 %).
	Open	With roof, enclosed at constant temperature and atmospheric humidity (5 °C < 9 < 60 °C, < 50 % relative atmospheric humidity). No sudden temperature fluctuations and controlled ventilation with filter (free from dirt and dust). No aggressive vapors and no shock loads. Protection against insect damage.	Two years or more given regular inspections. Check for cleanliness and mechanical damage as part of the inspection. Check corrosion protection.

1) Packaging must be performed by an experienced company using the packaging materials that have been expressly specified for the particular application.

**Installation /
assembly**

Observe the instructions in the sections "Installation" and "Assembly/Removal"!

**Startup /
operation**

Check that the direction of rotation is correct in **decoupled** status. Listen out for unusual grinding noises as the shaft rotates.

Secure the shaft keys for test mode without drive components. Do not render monitoring and protection equipment inoperative even for test mode.

Switch off the gearmotor if in doubt whenever changes occur in relation to normal operation (e.g. increased temperature, noise, vibration). Determine the cause; contact SEW-EURODRIVE if necessary.

**Inspection /
maintenance**

Follow the instructions in the section "Inspection and Maintenance"!

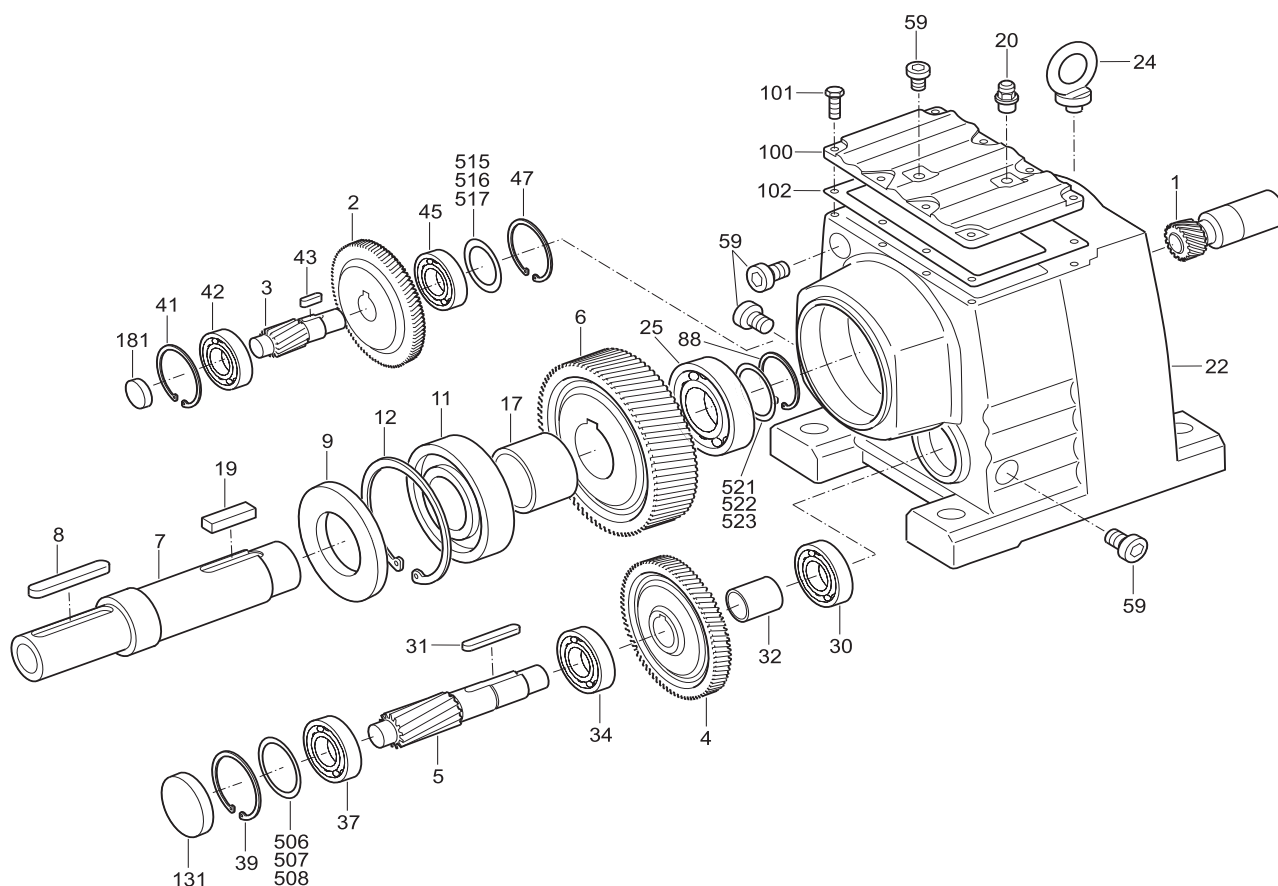


3 Gear Unit Structure



The following figures are block diagrams. Their purpose is only to make it easier to assign components to the spare parts lists. Discrepancies may occur depending on the gear unit size and version!

3.1 Basic structure of helical gear units



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Figure 1: Basic structure of helical gear units

Key

1 Pinion	19 Key	42 Anti-friction bearing	507 Shim ring
2 Gear	20 Breather valve	43 Key	508 Shim ring
3 Pinion shaft	22 Gearcase	45 Anti-friction bearing	515 Shim ring
4 Gear	24 Lifting eyebolt	47 Circlip	516 Shim ring
5 Pinion shaft	25 Anti-friction bearing	59 Screw plug	517 Shim ring
6 Gear	30 Anti-friction bearing	88 Circlip	521 Shim ring
7 Output shaft	31 Key	100 Gearcase cover	522 Shim ring
8 Key	32 Spacer	101 Hex head bolt	523 Shim ring
9 Oil seal	34 Anti-friction bearing	102 Gasket	
11 Anti-friction bearing	37 Anti-friction bearing	131 Closing cap	
12 Circlip	39 Circlip	181 Closing cap	
17 Spacer	41 Circlip	506 Shim ring	



3.6 Nameplate, unit designation

Sample nameplate

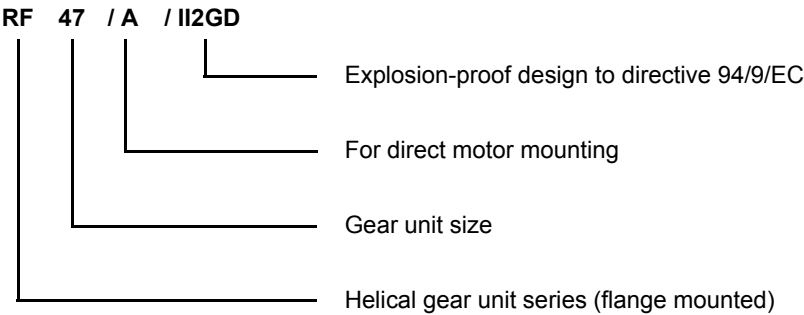
SEW-EURODRIVE, INC. USA				SEW	
Type	R77DT100L4				
S.O.	850012345 . 00 . 00 . 001				
In	1680	rpm	Out	58	rpm
HP			Torque	5440	lb-in
Ratio	29.00		Service Factor	1.4	
Mounting Position	B3				
Lubrication	MOBILGEAR 600 XP 220		0 °C	40 °C	
A Mobil Product	See Operating Instructions for lubrication details		Min Amb	Max Amb	

Figure 6: Sample nameplate

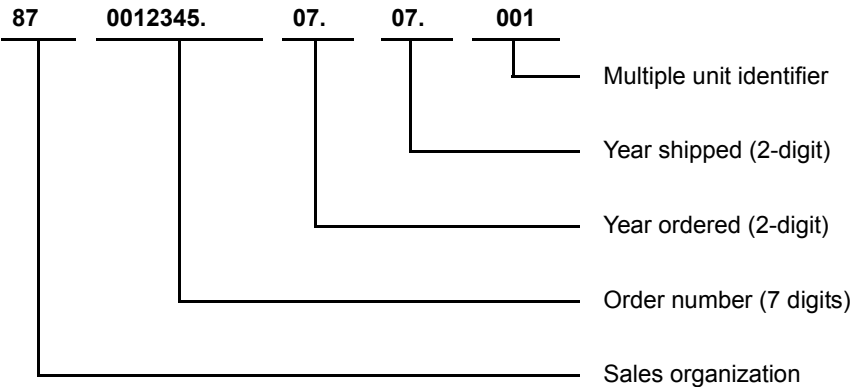
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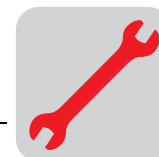
Unit designation

Example: Helical gear unit, category II2GD



Example: Serial number





4 Mechanical Installation

4.1 Required tools / aids

- Set of spanners
- Torque wrench for:
 - Shrink discs
 - AQH motor adapter
 - Input shaft assembly with centering shoulder
- Mounting device
- Shims and distance rings if necessary
- Fixing devices for input and output elements
- Lubricant (e.g. NOCO® Fluid)
- Bolt adhesive (for input shaft assembly with centering shoulder), e.g. Loctite® 243
- Standard parts are not part of the delivery

Installation tolerances

Shaft end	Flanges
Diameter tolerance in accordance with DIN 748 <ul style="list-style-type: none"> • ISO k6 for solid shafts with $\varnothing \leq 50$ mm (1.97") • ISO m6 for solid shafts with $\varnothing > 50$ mm (1.97") • ISO H7 for hollow shafts • Center bore in accordance with DIN 332, shape DR 	Centering shoulder tolerance in accordance with DIN 42948 <ul style="list-style-type: none"> • ISO j6 with $b1 \leq 230$ mm (9.06") • ISO h6 with $b1 > 230$ mm (9.06")

4.2 Prerequisites for assembly

Check that the following conditions have been met:

- The data on the nameplate of the gearmotor matches the voltage supply system.
- The drive has not been damaged during transportation or storage.
- Ensure that the following requirements have been met:
 - **For standard gear units:**
 Ambient temperature according to the lubricant table in Sec. "Lubricants" (see standard).
 The drive must not be assembled in the following ambient conditions:
 - Potentially explosive atmosphere
 - Oil
 - Acids
 - Gas
 - Vapors
 - Radiation
 - **For special versions:**
 The drive configured in accordance with the ambient conditions.
 - **For helical-worm / SPIROPLAN® W gear units:**
 No large external mass moments of inertia which could exert a retrodriving load on the gear unit.
 [At η' (retrodriving) = $2 - 1/\eta < 0.5$ self-locking]



- You must clean the output shafts and flange surfaces thoroughly to ensure they are free of anti-corrosion agents, contamination or similar. Use a commercially available solvent. Do not let the solvent come into contact with the sealing lips of the oil seals – danger of damage to the material!
- When the drive is installed in abrasive ambient conditions, protect the output end oil seals against wear.

4.3 Installing the gear unit

The gear unit or gearmotor is only allowed to be installed in the specified mounting position. ~~SPIROPLAN® gear units are not dependent on the mounting position.~~

The support structure must have the following characteristics:

- Level
- Vibration damping
- Torsionally rigid

Maximum permitted flatness error for foot and flange mounting (approximate values with reference to DIN ISO 1101):

- Gear unit size ≤ 67 : max. 0.4 mm (0.016")
- Gear unit size 77 ... 107: max. 0.5 mm (0.020")
- Gear unit size 137 ... 147: max. 0.7 mm (0.028")
- Gear unit size 157 ... 187: max. 0.8 mm (0.031")

Do not tighten the housing legs and mounting flanges against one another and ensure that you comply with the permitted overhung and axial loads!

Secure the gearmotors with bolts of quality 8.8.

Secure the following gearmotors with bolts of quality 10.9:

- RF37, R37F with flange \varnothing 120 mm (4.72")
- RF47, R47F with flange \varnothing 140 mm (5.51")
- RF57, R57F with flange \varnothing 160 mm (6.30")



The oil checking and drain screws and the breather valves must be freely accessible!

At the same time, also check that the oil fill is as specified for the mounting position (see Sec. "Lubricants" / "Lubricant fill quantities" or refer to the information on the nameplate). The gear units are filled with the required oil volume at the factory. There may be slight deviations at the oil level plug as a result of the mounting position, which are permitted within the manufacturing tolerances.



Adjust the lubricant fill volumes and the position of the breather valve accordingly in the event of a change of mounting position.

~~Please contact our SEW customer service if you change the mounting position of K gear units to M5 or M6 or between M5 and M6.~~

~~Please contact our SEW customer service if you change the mounting position of size S47–S97 G gear units to mounting position M2.~~

Use plastic inserts (2 ... 3 mm thick) if there is a risk of electrochemical corrosion between the gear unit and the driven machine. The material used must have an electrical bleeder resistor $< 10^9 \Omega$. Electrochemical corrosion can occur between various metals, for example, cast iron and high-grade steel. Also install the bolts with plastic washers! Ground the housing additionally – use the grounding bolts on the motor.

*Installation in
damp locations or
in the open*

Drives are supplied in corrosion-resistant versions for use in damp areas or in the open air. Repair any damage to the paint work (e.g. on the breather valve).

When mounting the motors onto AM, ~~AQ, AP, AT~~ adapters, seal the flange areas with a suitable sealing compound, e.g. Loctite® 574.



Mechanical Installation

Installing the gear unit

Gear unit venting

No breather plug is required for the following gear units:

- ~~R07~~ in mounting positions M1, M2, M3, M5 and M6
- ~~R17, R27 and F27~~ in mounting positions M1, M3, M5 and M6
- ~~SPIROPLAN® W~~ gear units

SEW-EURODRIVE supplies all other gear units with the breather valve installed and activated according to the particular mounting position.

Exceptions:

1. SEW supplies the following gear units with a screw plug on the vent hole provided:
 - Gear units for extended storage
 - Pivoted mounting positions, if possible
 - Gear units for mounting on a slant

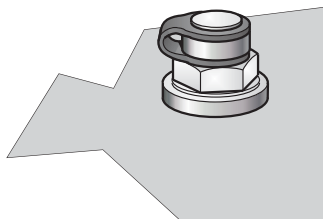
The breather valve is supplied with the unit. Before startup, you must install the breather plug in the location specified.

2. SEW supplies a breather valve in a plastic bag for **gear head units** requiring venting on the input end.
3. **Enclosed gear units** are supplied without a breather valve.

Activating the breather valve

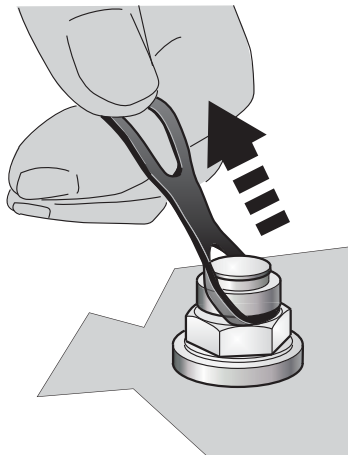
If the breather valve has not been activated, you must remove the transport fixture from the breather valve before starting up the gear unit!

1. Breather valve with transport fixture



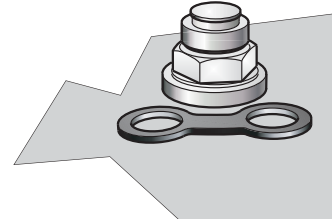
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2. Remove the transport fixture



02054BXX

3. Breather valve activated



02055BXX

Painting the gear unit

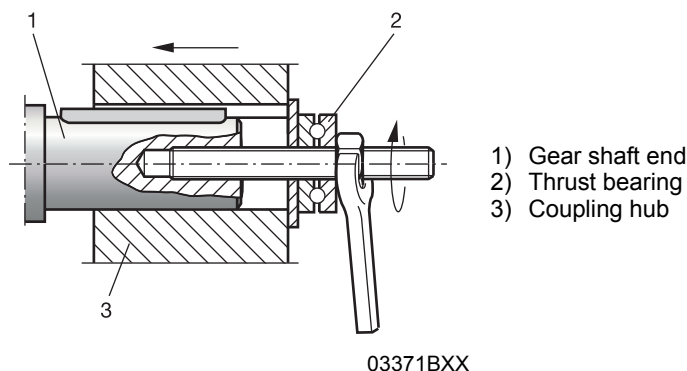
If you paint or respray the drive, ensure that you cover the breather valve and oil seals carefully. Remove the strips of tape after completing the painting work.



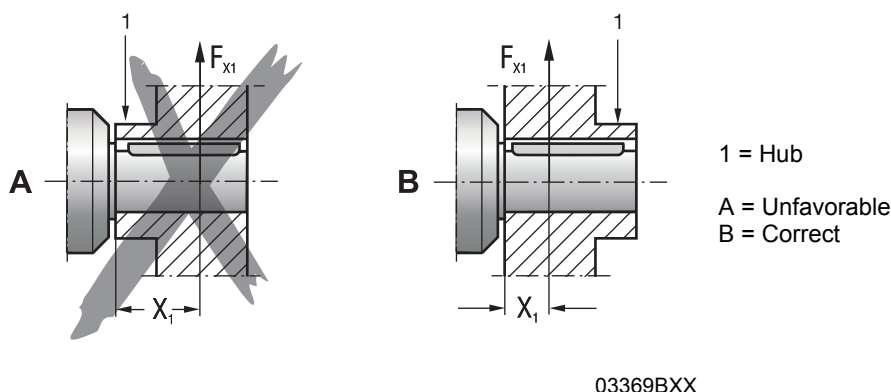
4.4 Gear unit with solid shaft

Installing input and output elements

The following figure shows a mounting device for installing couplings or hubs on gear unit or motor shaft ends. It may be possible to dispense with the thrust bearing on the mounting device.



Avoid impermissibly high overhung loads: Install the gear or chain sprocket according to figure B.



- Only use a mounting device for installing input and output elements. Use the center bore and the thread on the shaft end for positioning.
- **Never drive belt pulleys, couplings, pinions, etc. onto the shaft end by hitting them with a hammer. This will damage the bearings, housing and the shaft!**
- **In the case of belt pulleys, make sure the belt is tensioned correctly in accordance with the manufacturer's instructions.**
- Power transmission elements should be balanced after fitting and must not give rise to any impermissible radial or axial forces (see the "Gearmotor" or "Explosion-Proof Drives" catalogs for permitted values).



Note:

Assembly is easier if you first apply lubricant to the output element or heat it up briefly to 80 ... 100 °C (176 ... 212°F).



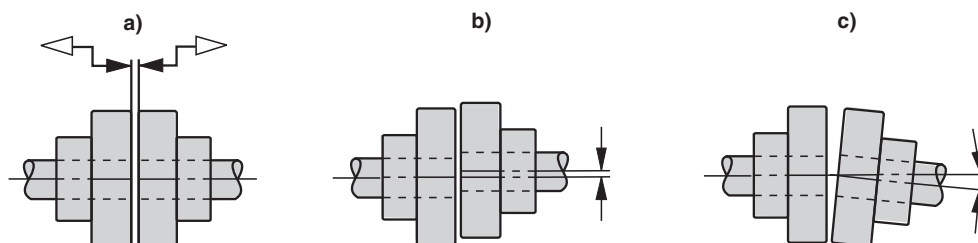
Mechanical Installation

Gear unit with solid shaft

Installing couplings

Couplings must be mounted and balanced according to the information provided by the coupling manufacturer:

- a) Maximum and minimum clearance
- b) Axial misalignment
- c) Angular misalignment



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Figure 7: Clearance and misalignment for coupling installation



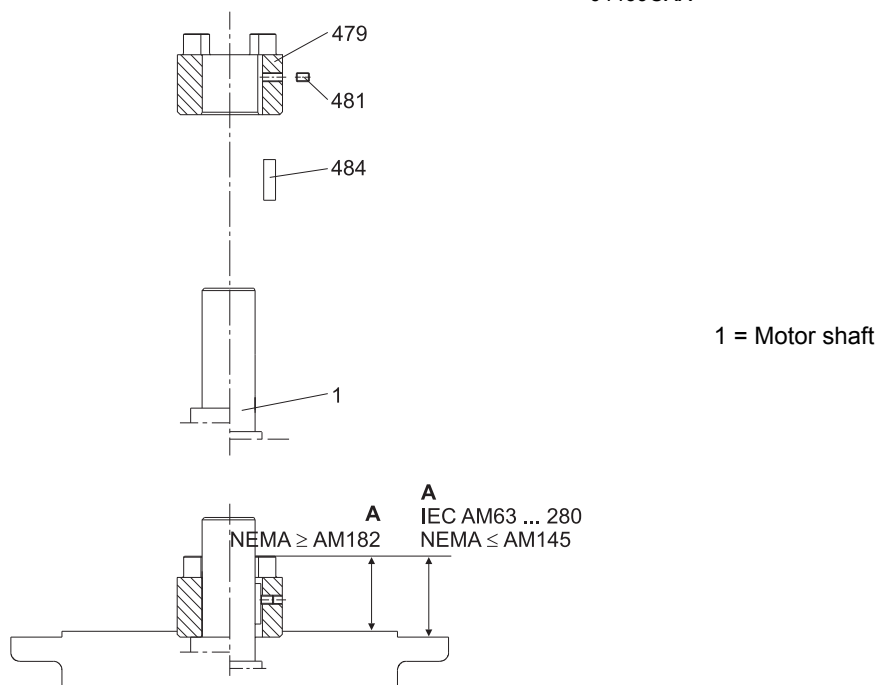
Input and output elements such as belt pulleys, couplings, etc. must be protected against contact!



4.9 AM adapter coupling

IEC adapter AM63
225 / NEMA
adapter AM56
365

04469CXX



1. Clean the motor shaft and flange surfaces of the motor and adapter.
2. Remove the key from the motor shaft and replace it with the supplied key (484) (not AM63 and AM250).
3. Heat the coupling half (479) to approx. 80 – 100 °C (176 – 212°F) and push the coupling half onto the motor shaft until stop at motor shaft shoulder (position to point **A** for AM250 / AM280 and NEMA).
4. Secure key and coupling half using set screw (481) and tightening torque T_A on motor shaft according to the table.
5. Check point **A**.
6. Seal the contact surfaces between the adapter and motor using a suitable sealing compound.
7. Mount the motor on the adapter. When doing this, make sure the coupling jaws of the adapter shaft engage the plastic spider.

IEC AM	uom	63 / 71	80 / 90	100 / 112	132	160 / 180	200	225	250 / 280
A	mm	24.5	31.5	41.5	54	76	78.5	93.5	139
	in	0.965	1.240	1.634	2.126	2.992	3.091	3.681	5.472
T_A	Nm	1.5	1.5	4.8	4.8	10	17	17	17
	lb-in	13.3	13.3	42.5	42.5	88.5	150	150	150
Thread		M4	M4	M6	M6	M8	M10	M10	M10
NEMA AM	uom	56	145 / 145	182 / 184	213 / 215	254 / 256	284 / 286	324 / 326	364 / 365
A	mm	46	43	55	63.5	78.5	85.5	107	107
	in	1.811	1.693	2.165	2.500	3.091	3.366	4.213	4.213
T_A	Nm	1.5	1.5	4.8	4.8	10	17	17	17
	lb-in	13.3	13.3	42.5	42.5	88.5	150	150	150
Thread		M4	M4	M6	M6	M8	M10	M10	M10



To avoid contact corrosion, we recommend applying NOCO[®] fluid to the motor shaft before mounting the coupling half.

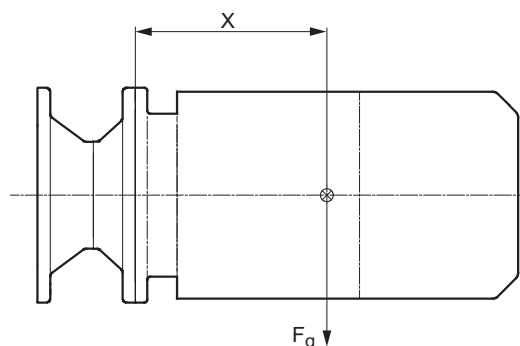


When installing a motor onto the adapter, you must use an anaerobic sealant to ensure that moisture cannot penetrate the adapter.

Permitted loads



The load data specified in the following table must not be exceeded when a motor is mounted.



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Adapter type		x ¹⁾ [mm (in)]	F _q ¹⁾ [N (lb)]	
IEC	NEMA		IEC adapter	NEMA adapter
AM63/71	AM56	77 (3.03)	550 (119)	410 (92)
AM80/90	AM143/145	113 (4.45)	420 (94)	300 (65)
AM100/112	AM182/184	144 (5.67)	2000 (450)	1760 (396)
AM132 ²⁾	AM213/215 ²⁾	180 (7.32)	1600 (360)	1250 (281)
AM132..	AM213/215		4700 (1057)	3690 (830)
AM160/180	AM254/286	251 (9.88)	4600 (1034)	4340 (976)
AM200/225	AM324 - AM365	297 (11.69)	5600 (1259)	5250 (1180)
AM250/280	-	390 (15.35)	11200 (2518)	-

1) The maximum permitted weight of the attached motor F_{qmax} must be reduced proportionally as the distance between the adapter flange and the middle of the motor (x) increases. When this distance is reduced, the maximum permitted weight F_{qmax} cannot be increased.

2) Diameter of the adapter drive flange: 160 mm (6.30 in)



Startup

Startup of helical-worm and SPIROPLAN® W gear units

5 Startup



Prior to startup check that the oil level is as specified for the mounting position. The oil checking and drain screws and the breather valves must be freely accessible.

5.1 ~~Startup of helical worm and SPIROPLAN® W gear units~~



~~Note: The direction of rotation of the output shaft in series S..7 helical-worm gear units has been changed from CW to CCW; this is different from the S..2 series. Change direction of rotation: Swap over two motor feeder cables.~~

~~Run-in period~~

~~SPIROPLAN® and helical-worm gear units require a run-in period of at least 24 hours before reaching their maximum efficiency. A separate run in period applies for each direction of rotation if the gear unit is operated in both directions of rotation. The table shows the average power reduction during the run-in period.~~

No. of starts	Worm		Spiroplan®	
	Power reduction	i range	Power reduction	i range
1 start	ca. 12 %	ca. 50...280	ca. 15 %	approx. 40 ... 75
2 start	ca. 6 %	ca. 20...75	ca. 10 %	ca. 20...30
3 start	ca. 3 %	ca. 20...90	ca. 8 %	ca. 15
4 start	-	-	ca. 6 %	ca. 10
5 start	ca. 3 %	ca. 6...25	ca. 5 %	ca. 8
6 start	ca. 2 %	ca. 7...25	-	-

5.2 ~~Startup of helical, parallel shaft helical and helical-bevel gear units~~

No special startup instructions are required for helical, parallel shaft helical and helical-bevel gear units providing the gear units have been installed in accordance with Sec. "Mechanical Installation".

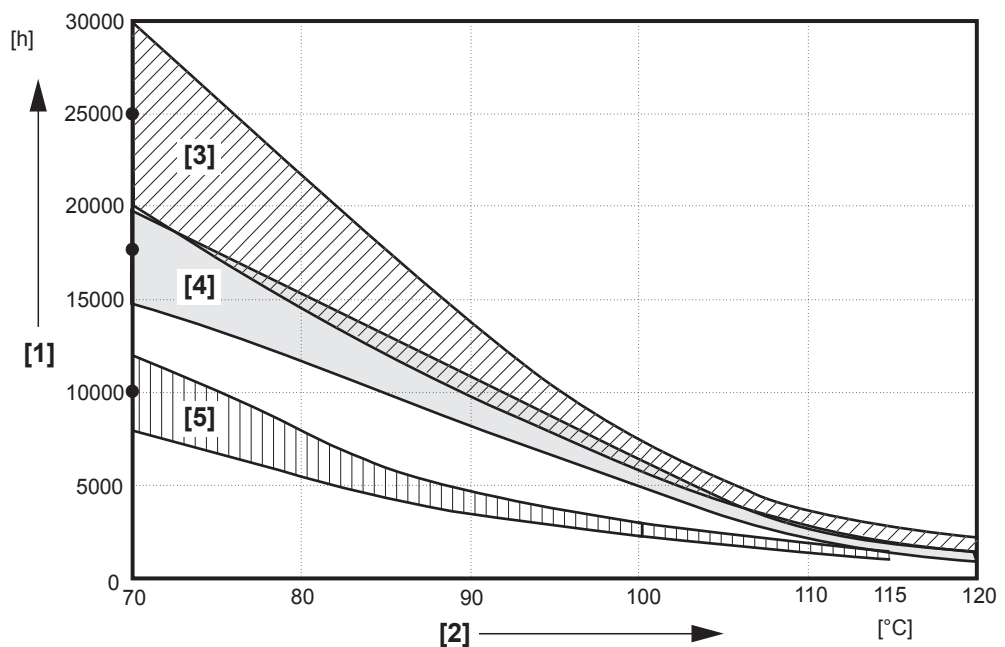


6 Inspection and Maintenance

6.1 Inspection and maintenance intervals

Frequency	What to do?
<ul style="list-style-type: none"> Every 3000 machine hours, at least every 6 months. 	<ul style="list-style-type: none"> Check oil and oil level. Check the seals visually for leakage. For gear units with a torque arm: Check the rubber buffer and change it, if necessary
<ul style="list-style-type: none"> Depending on the operating conditions (see chart below), every 3 years at the latest. According to oil temperature. 	<ul style="list-style-type: none"> Change mineral oil. Replace anti-friction bearing grease (recommendation). Replace oil seal (do not install it in the same track).
<ul style="list-style-type: none"> Depending on the operating conditions (see chart below), every 5 years at the latest. According to oil temperature. 	<ul style="list-style-type: none"> Change synthetic oil Replace anti-friction bearing grease (recommendation). Replace oil seal (do not install it in the same track).
<ul style="list-style-type: none"> Gear units R07, R17, R27, F27 and Spiroplan® are have lubrication for life and are therefore maintenance-free 	
<ul style="list-style-type: none"> Varying (depending on external factors). 	<ul style="list-style-type: none"> Touch up or renew the surface/anticorrosion coating.

6.2 Lubricant change intervals



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Figure 13: Oil change intervals for standard gear units under normal environmental conditions

[1] Operating hours

[2] Sustained oil bath temperature

- Average value per oil type at 70 °C

[3] CLP PG

[4] CLP HC / HCE 

[5] CLP / HLP / E 



6.3 Inspection and maintenance of the gear unit

Do not intermix synthetic lubricants and do not mix synthetic and mineral lubricants together!

The standard lubricant is mineral oil (except for Spiroplan® gear units).

The position of the oil level and oil drain plug and the breather valve depends on the mounting position. Refer to the diagrams of the mounting positions.

Checking the oil level



1. **De-energize the gearmotor and secure it to prevent it from being switched on inadvertently!**

Wait until the gear unit has cooled off – Danger of burns!

2. Refer to Sec. "Installing the gear unit" when changing the mounting position!
3. For gear units with an oil level plug: Remove the oil level plug, check the fill level and correct it if necessary. Screw the oil level plug back in.

Checking the oil



1. **De-energize the gearmotor and secure it to prevent it from being switched on inadvertently!**

Wait until the gear unit has cooled off – Danger of burns!

2. Remove a little oil from the oil drain plug.
3. Check the oil consistency.
 - Viscosity
 - If you can see that the oil is heavily contaminated, we recommend that you change the oil even if this is outside the service intervals specified in "Inspection and maintenance periods".
4. For gear units with an oil level plug: Remove the oil level plug, check the fill level and correct it if necessary. Screw the oil level plug back in.

Changing the oil



Only change the oil when the gear unit is at operating temperature.

De-energize the gearmotor and secure it to prevent it from being switched back on inadvertently!

Wait until the gear unit cools down - Danger of burns!

Note: The gear unit must still be warm otherwise the high viscosity of excessively cold oil will make it harder to drain the oil correctly.

With oil drain plug / oil level screw

1. Place a container underneath the oil drain plug
2. Remove the oil level plug, breather plug/breather valve and oil drain plug.
3. Drain all the oil.
4. Screw in the oil drain plug.
5. Pour in new oil of the same type through the vent hole (if changing the oil type, please first contact our customer service). Do not mix synthetic lubricants.
 - Pour in the volume of oil in accordance with the mounting position (see Sec. "Lubricant fill quantities") or as specified on the nameplate.
 - Check at the oil level plug.
6. Screw the oil level plug back in
7. Screw in the breather plug/breather valve.



Without oil drain plug / oil level plug

1. Remove cover plate.
2. Drain the oil through the cover plate opening.
3. Pour in new oil of the same type through the vent hole (if changing the oil type, please first contact our customer service). Do not mix synthetic lubricants.
 - Pour in the volume of oil in accordance with the mounting position (see Sec. "Lubricant fill quantities") or as specified on the nameplate.
4. Check the oil level (→ Sec. "Check oil level for gear units with oil level plug")
5. Attach cover plate (observe the tightening torque and series → Sec. "Check the oil level for gear units without an oil level plug")

Changing the oil seal



1. **De-energize the gearmotor and secure it to prevent it from being switched on inadvertently!**

Wait until the gear unit has cooled off – Danger of burns!

2. When changing the oil seal, ensure that there is a sufficient grease reservoir between the dust lip and protective lip, depending on the type of gear unit.
3. If you use double oil seals, the space has to be filled one-third with grease.

6.4 Inspection / maintenance of AM / AQA adapters

Frequency	What to do?
<ul style="list-style-type: none"> Every 3000 machine hours, at least every 6 months 	<ul style="list-style-type: none"> Check torsional play Visually check the elastic annular gear Check the adapter visually for leakage
<ul style="list-style-type: none"> After 25000 - 30000 machine hours 	<ul style="list-style-type: none"> Renew the anti-friction bearing grease Replace oil seal (do not install it in the same track) Change the elastic coupling spider

6.5 Inspection / maintenance of AD adapters

Frequency	What to do?
<ul style="list-style-type: none"> Every 3000 machine hours, at least every 6 months 	<ul style="list-style-type: none"> Check running noise for possible bearing damage Check the adapter visually for leakage
<ul style="list-style-type: none"> After 25000 - 30000 machine hours 	<ul style="list-style-type: none"> Renew the anti-friction bearing grease Change the oil seal



7 Malfunctions

Customer service

Please have the following information to hand if you require the assistance of our customer service:

- Data from the nameplate (complete)
- Nature and extent of the fault
- Time and peripheral circumstances of the fault
- Presumed cause

7.1 Gear unit malfunctions

Problem	Possible cause	Remedy
Unusual, regular running noise	A Meshing/grinding noise: Bearing damage. B Knocking noise: Irregularity in the gearing	A Check the oil (see Sec. "Inspection and Maintenance"), change bearings B Contact customer service
Unusual, irregular running noise	Foreign bodies in the oil	<ul style="list-style-type: none"> • Check the oil (see Sec. "Inspection and Maintenance") • Stop the drive, contact customer service
Oil leaking ¹⁾ <ul style="list-style-type: none"> • From the gear cover plate • From the motor flange • From the motor oil seal • From the gear unit flange • From the output end oil seal 	A Rubber seal on the gear cover plate leaking B Seal defective C Gear unit not vented	A Tighten the bolts on the gear cover plate and observe the gear unit. Oil still leaking: Contact customer service B Contact customer service C Vent the gear unit (see Sec. "Mounting Positions")
Oil leaking from breather valve	A Too much oil B Drive operated in incorrect mounting position C Frequent cold starts (oil foams) and/or high oil level	A Correct the oil level (see Sec. "Inspection and Maintenance") B Mount the breather valve correctly (see Sec. "Mounting Positions") and correct the oil level (see "Lubricants")
Output shaft does not turn although the motor is running or the input shaft is rotated	Connection between shaft and hub in gear unit interrupted	Send in the gear unit/gearmotor for repair

1) Short-term oil/grease leakage at the oil seal is possible in the run-in phase (24 hours running time).

7.2 ~~AM / AGA / AL~~ adapter malfunctions

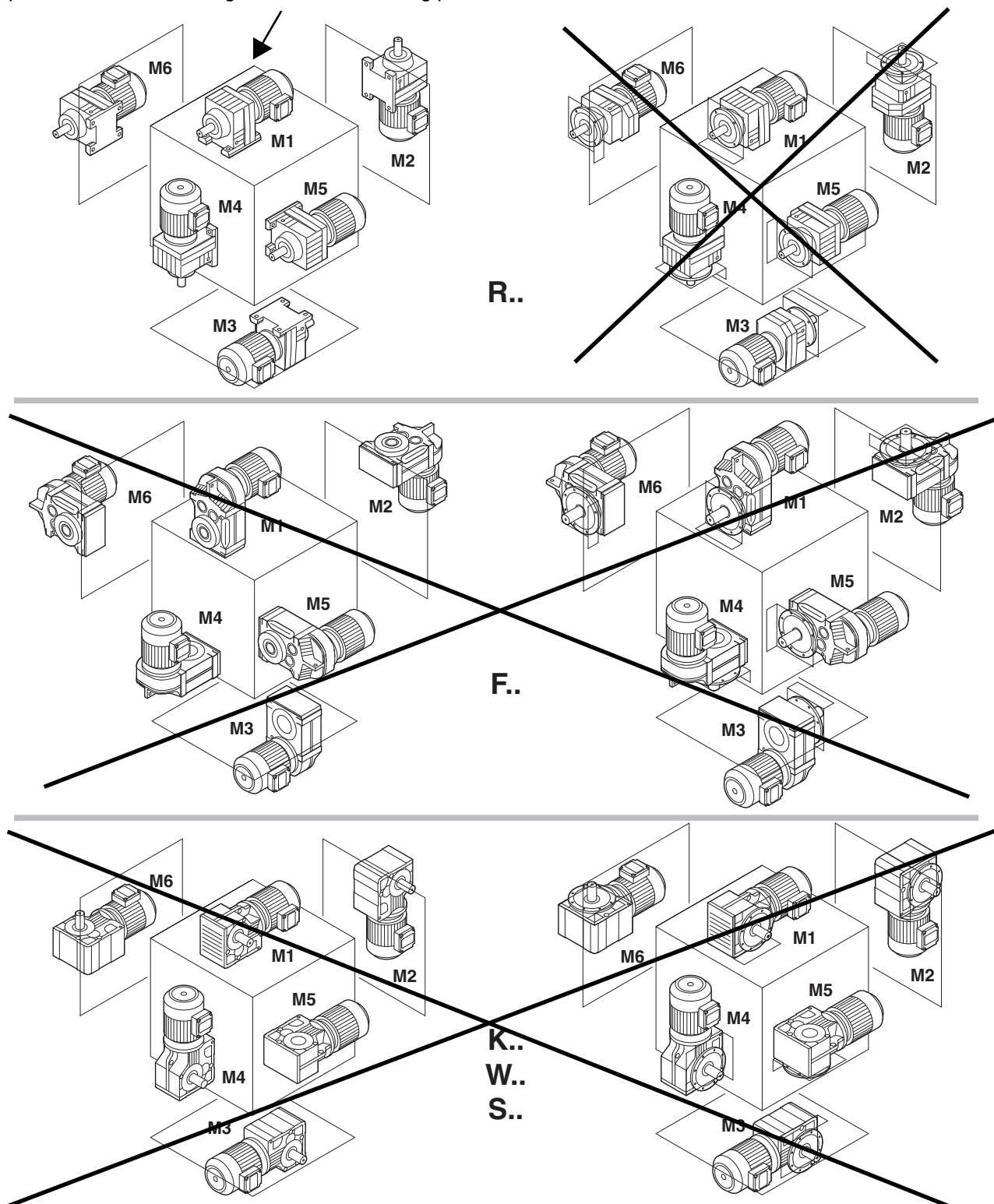
Problem	Possible cause	Remedy
Unusual, regular running noise	Meshing/grinding noise: Bearing damage	Contact SEW-EURODRIVE customer service
Oil leaking	Seal defective	Contact SEW-EURODRIVE customer service
Output shaft does not turn although the motor is running or the input shaft is rotated	Connection between shaft and hub in gear unit interrupted	Send the gear unit to SEW-EURODRIVE for repair.
Change in running noise and / or vibrations occur	A Annular gear wear, short-term torque transfer through metal contact B Bolts to secure hub axially are loose.	A Change the coupling spider B Tighten the bolts
Premature wear in annular gear	A Contact with aggressive fluids / oil; ozone influence; too high ambient temperatures etc, which can cause a change in the physical properties of the annular gear. B Impermissibly high ambient/contact temperature for the annular gear; maximum permitted temperature –20 °C to +80 °C. C Overload	Contact SEW-EURODRIVE customer service

8 Mounting Positions

8.1 General information on mounting positions

Mounting position designation

SEW differentiates between six mounting positions M1 ... M6 for gear units. The following figure shows the spatial orientation of the gearmotor in mounting positions M1 ... M6.



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Figure 14: Depiction of mounting positions M1 ... M6

8.2 Key to the mounting position sheets


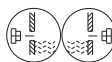



SPIROPLAN® gearmotors do not depend on any particular mounting position. However, mounting positions M1 to M6 are also shown for SPIROPLAN® gearmotors to assist you in working with this documentation.

Important: SPIROPLAN® gearmotors cannot be equipped with breather valves, oil level plugs or drain plugs.

Symbols used





The following table shows the symbols used in the mounting position sheets and what they mean:

Symbol	Meaning
	Breather valve
	Oil level plug
	Oil drain plug

Churning losses



Increased churning losses may arise in some mounting positions. Contact SEW-EURODRIVE in case of the following combinations:

Mounting position	Gear unit type	Gear unit size	Input speed [rpm]
M2, M4		97 ... 107	>2500
		107	>1500
M2, M3, M4, M5, M6		97 ... 107	>2500
		107	>1500
		77 ... 107	>2500
		107	>1500
		77 ... 97	>2500
		97	>1500

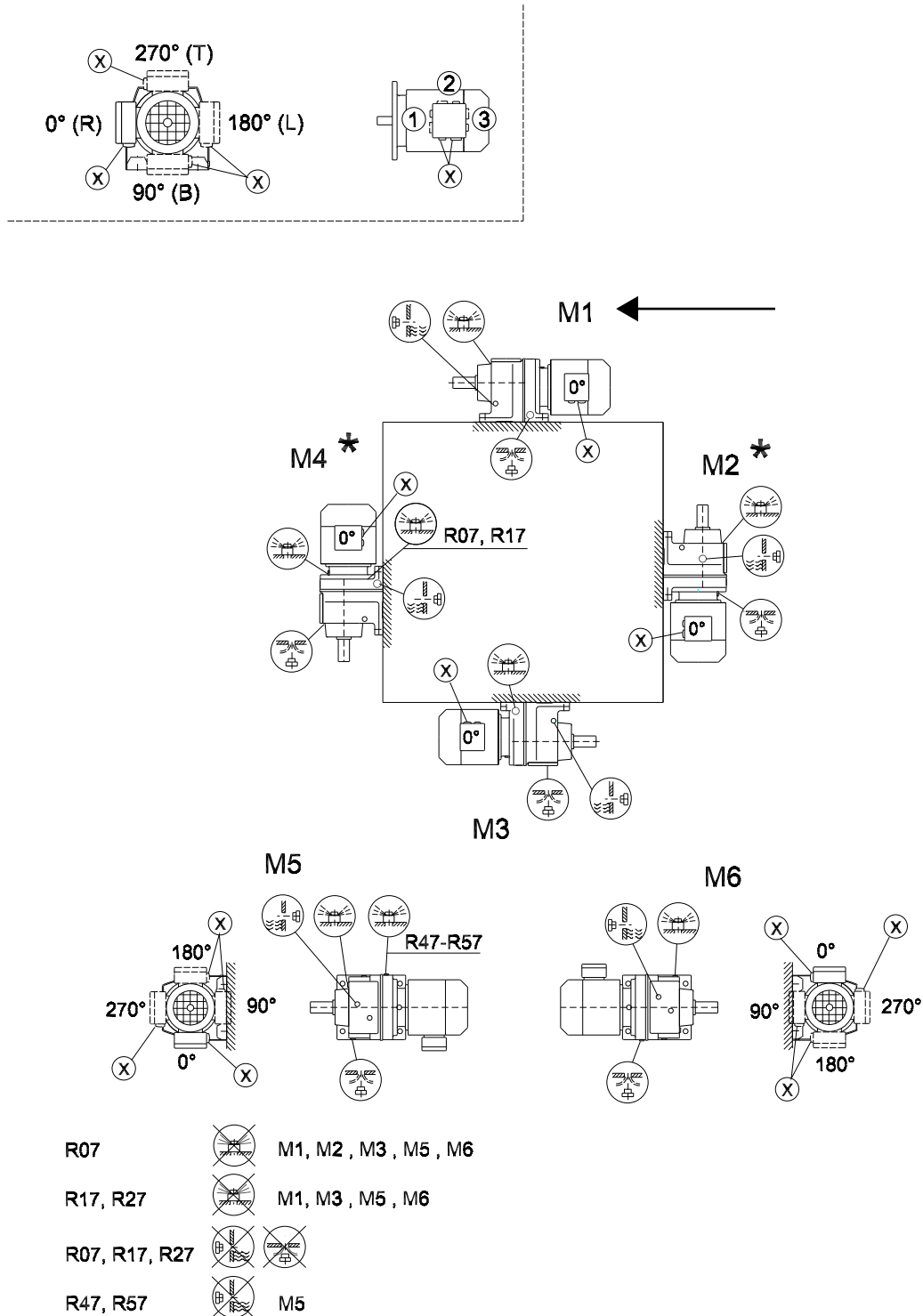
Mounting Positions

Mounting positions for R helical gearmotors

8.3 Mounting positions for R helical gearmotors

R07-R167

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* → page 51



9 Lubricants

General information


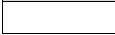


Unless a special arrangement is made, SEW-EURODRIVE supplies the drives with a lubricant fill adapted for the specific gear unit and mounting position. The decisive factor is the mounting position (M1 ... M6, → Sec. "Mounting Positions and Important Order Information") specified when ordering the drive. You must adapt the lubricant fill to any subsequent changes made to the mounting position (→ Lubricant fill quantities).

9.1 Lubricant table

Key to the lubricant table

The lubricant table on the following page shows the permitted lubricants for SEW-EURODRIVE gear units. Please note the following key to the lubricant table.

Abbreviations used, meaning of shading and notes:

CLP	= Mineral oil
CLP PG	= Polyglycol (W gear units, NSF certified H1)
CLP HC	= Synthetic hydrocarbons
E	= Ester oil (water hazard class 1 (German regulation))
HCE	= Synthetic hydrocarbons + ester oil (NSF certified H1)
HLP	= Hydraulic oil
	= Synthetic lubricant (= synthetic-based anti-friction bearing grease)
	= Mineral lubricant (= mineral-based anti-friction bearing grease)
1)	Helical-worm gear units with PG oil: Please contact SEW-Eurodrive
2)	Special lubricant for Spiroplan® gear units only
3)	SEW $f_B \geq 1.2$ required
4)	Pay attention to critical starting behavior at low temperatures!
5)	Ambient temperature
	Lubricant for the food industry (food grade oil)
	Biodegradable oil (lubricant for use in agriculture, forestry and water resources)



Anti-friction bearing greases

The anti-friction bearings in gear units and motors are given a factory-fill with the greases listed below. SEW-EURODRIVE recommends regreasing anti-friction bearings with a grease fill at the same time as changing the oil.

	Ambient temperature	Manufacturer	Type
Anti-friction bearing in gear unit	-20 °C ... +60 °C	Mobil	Mobilux EP2
	-40 °C ... +60 °C	Mobil	Mobiltemp SHC 100
Anti-friction bearing in motor ¹⁾²⁾	-20 °C ... +80 °C	Esso	Polyrex EM
	+20 °C ... +100 °C	Klüber	Barrierta L55/2
	-40 °C ... +60 °C	Kyodo Yushi	Multemp SRL ³⁾
Special greases for anti-friction bearings in gear units:			
	-35 °C ... +40 °C	Shell	Shell Cassida Grease EPS 2
	-25 °C ... +40 °C	Klüber	Klüberynth LH1 14-222
	-40 °C ... +40 °C	Klüber	Klüberbio M 72-82

- 1) The motor anti-friction bearings are covered on both sides and cannot be regreased.
- 2) Greases providing equivalent performance are acceptable
- 3) Recommended for continuous operation at ambient temperature below 0°C, example in a cold storage.



The following grease quantities are required:

- For fast-running bearings (motor and gear unit input end): Fill the cavities between the rolling elements one third full with grease.
- For slow-running bearings (in gear units and at gear unit output end): Fill the cavities between the rolling elements two thirds full with grease.

Lubricant table

	5)		DIN (ISO)	ISO, NLGI	ExxonMobil	Shell	KLÜBER	ARAL	bp	Tribol	TEXACO	Optimol	FUCHS	TOTAL
R...		Standard -10 +40	CLP (CC)	VG 220	Mobilgear 600XP 220	Shell Omala 220	Klüberoil GEM 1-220 N	Aral Degol BG 220	BP Energol GR-XP 220	Tribol 1100/220	Meropa 220	Optigear BM 220	Renolin CLP 220	Carter EP 220
KL... (HK...)		-25 +80	CLP PG	VG 220	Mobil Glygoile 30	Shell Tivela S 220	Klübersynth GH 6-220	Aral Degol GS 220	BP Energol SG-XP 220	Tribol 800/220	Synlube CLP 220	Optiflex A 220		Carter SY 220
F...		-40 +80	CLP HC	VG 220	Mobil SHC 630	Shell Omala HD 220	Klübersynth GEM 4-220 N	Aral Degol PAS 220	BP Energol SG-XP 220	Tribol 1510/220	Pinnacle EP 220	Optigear Synthetic A 220	Renolin Unisyn CLP 220	
		-40 +40		VG 150	Mobil SHC 629	Shell Omala HD 150	Klübersynth GEM 4-150 N				Pinnacle EP 150			Carter SH 150
		-20 +25	CLP (CC)	VG 150	Mobilgear 600XP 100	Shell Omala 100	Klüberoil GEM 1-150 N	Aral Degol BG 100	BP Energol GR-XP 100	Tribol 1100/100	Meropa 150	Optigear BM 100	Renolin CLP 150	Carter EP 100
		-30 +10	HLP (HM)	VG 68-46	Mobil D.T.E. 13M	Shell Tellus T 32	Klüberoil GEM 1-68 N	Aral Degol BG 46		Tribol 1100/68	Rando EP Ashless 46	Optigear 32	Renolin B 46 HVI	Equivis ZS 46
		-40 +10	CLP HC	VG 32	Mobil SHC 624		Klüber-Summit HySyn FG-32				Cetus PAO 46			Dacnis SH 32
		-40 -20	HLP (HM)	VG 22	Mobil D.T.E. 11M	Shell Tellus T 15	Isoflex MT 30 ROT		BP Energol HLP-HM 15		Rando HDZ 15			Equivis ZS 15
S... (HS...)		Standard 0 +40	CLP (CC)	VG 680	Mobilgear 600XP 680	Shell Omala 680	Klüberoil GEM 1-680 N	Aral Degol BG 680	BP Energol GR-XP 680	Tribol 1100/680	Meropa 680	Optigear BM 680	Renolin CLP 680	Carter EP 680
		-20 +60	CLP PG	VG 680 ¹⁾		Shell Tivela S 680	Klübersynth GH 6-680		BP Energol SG-XP 680	Tribol 800/680	Synlube CLP 680			
		-30 +80	CLP HC	VG 460	Mobil SHC 634	Shell Omala HD 460	Klübersynth GEM 4-460 N				Pinnacle EP 460			
		-40 +10		VG 150	Mobil SHC 629	Shell Omala HD 150	Klübersynth GEM 4-150 N				Pinnacle EP 150			Carter SH 150
		-20 +10	CLP (CC)	VG 150	Mobilgear 600XP 100	Shell Omala 100	Klüberoil GEM 1-150 N	Aral Degol BG 100	BP Energol GR-XP 100	Tribol 1100/100	Meropa 150	Optigear BM 100	Renolin CLP 150	Carter EP 100
		-25 +20	CLP PG	VG 220 ¹⁾	Mobil Glygoile 30	Shell Tivela S 220	Klübersynth GH 6-220	Aral Degol GS 220	BP Energol SG-XP 220	Tribol 800/220	Synlube CLP 220	Optiflex A 220		Carter SY 220
		-40 0	CLP HC	VG 32	Mobil SHC 624		Klüber-Summit HySyn FG-32				Cetus PAO 46			Dacnis SH 32
R... K... (HK...), F... (HS...)		Standard -20 +40	CLP PG	VG 460 ¹⁾			Klübersynth GH 6-460							
		-30 +40	HCE	VG 460		Shell Cassida Fluid GL 460	Klüberoil 4UH1-460 N	Aral Eural Gear 460				Optileh GT 460		
		-20 +40	E	VG 460			Klüberbio CA2-460	Aral Degol BAB 460				Optisynth BS 460		
N... (HW...)		Standard -20 +40	SEW PG	VG 460 ²⁾			Klüber SEW HT-460-5							
		-40 +10	API GL5	SAE 75W90 (-VG 100)	Mobilube SHC 75W90-L.S.		Klübersynth 1UH1-6-460							
		-20 +40	CLP PG	VG 460 ³⁾			Klübersynth 1UH1-6-460							



9.2 Lubricant fill quantities

The specified fill quantities are **recommended values**. The precise values vary depending on the number of stages and gear ratio. When filling, it is essential to check the **oil level plug** since it indicates the precise oil capacity.

The following tables show guide values for lubricant fill quantities in relation to the mounting position M1 ... M6.

Helical (R) gear units

Gear unit type R..., R..F	Fill quantity in liters					
	M1 ¹⁾	M2 ¹⁾	M3	M4	M5	M6
R07/R07F	0.12	0.20	0.20	0.20	0.20	0.20
R17/R17F	0.25	0.55	0.35	0.55	0.35	0.55
R27/R27F	0.25/0.40	0.70	0.50	0.70	0.50	0.50
R37/R37F	0.30/0.95	0.85	0.95	1.05	0.75	0.95
R47/R47F	0.70/1.50	1.60	1.50	1.65	1.50	1.50
R57/R57F	0.80/1.70	1.90	1.70	2.10	1.70	1.70
R67/R67F	1.10/2.30	2.60/3.50	2.80	3.20	1.80	2.00
R77/R77F	1.20/3.00	3.80/4.10	3.60	4.10	2.50	3.40
R87/R87F	2.30/6.0	6.7/8.2	7.2	7.7	6.3	6.5
R97	4.60/9.8	11.7/14.0	11.7	13.4	11.3	11.7
R107	6.0/13.7	16.3	16.9	19.2	13.2	15.9
R137	10.0/25.0	28.0	29.5	31.5	25.0	25.0
R147	15.4/40.0	46.5	48.0	52.0	39.5	41.0
R167	27.0/70.0	82.0	78.0	88.0	66.0	69.0
Gear unit type RF.. / RM..	Fill quantity in liters					
	M1 ¹⁾	M2 ¹⁾	M3	M4	M5	M6
RF07	0.12	0.20	0.20	0.20	0.20	0.20
RF17	0.25	0.55	0.35	0.55	0.35	0.35
RF27	0.25/0.40	0.70	0.50	0.70	0.50	0.50
RF37	0.35/0.95	0.90	0.95	1.05	0.75	0.95
RF47	0.65/1.50	1.60	1.60	1.65	1.50	1.50
RF/RM57	0.80/1.70	1.80	1.70	2.00	1.70	1.70
RF/RM67	1.20/2.50	2.70/3.60	2.70	2.60	1.90	2.10
RF/RM77	1.20/2.60	3.80/4.10	3.30	4.10	2.40	3.00
RF/RM87	2.40/6.0	6.8/7.9	7.1	7.7	6.3	6.4
RF/RM97	5.1/10.2	11.9/14.0	11.2	14.0	11.2	11.8
RF/RM107	6.3/14.9	15.9	17.0	19.2	13.1	15.9
RF/RM137	9.5/25.0	27.0	29.0	32.5	25.0	25.0
RF/RM147	16.4/42.0	47.0	48.0	52.0	42.0	42.0
RF/RM167	26.0/70.0	82.0	78.0	88.0	65.0	71.0

1) The output end gear unit of multi-stage gear units must be filled with the larger oil volume.



**Integral Horsepower
AC Induction Motors
~~ODP, WPI, WPII Enclosure~~
~~TEFC Enclosure~~
Explosion Proof**

Installation & Operating Manual

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Section 1

General Information

Overview This manual contains general procedures that apply to Baldor Motor products. Be sure to read and understand the Safety Notice statements in this manual. For your protection, do not install, operate or attempt to perform maintenance procedures until you understand the Warning and Caution statements. A Warning statement indicates a possible unsafe condition that can cause harm to personnel. A Caution statement indicates a condition that can cause damage to equipment.

Important: **This instruction manual is not intended to include a comprehensive listing of all details for all procedures required for installation, operation and maintenance. This manual describes general guidelines that apply to most of the motor products shipped by Baldor. If you have a question about a procedure or are uncertain about any detail, Do Not Proceed. Please contact your Baldor distributor for more information or clarification.**

Before you install, operate or perform maintenance, become familiar with the following:

- NEMA Publication MG-2, Safety Standard for Construction and guide for Selection, Installation and Use of Electric Motors and Generators.
- The National Electrical Code
- Local codes and Practices

Limited Warranty

1. Most Baldor products are warranted for 18 months from the date of shipment to Baldor's customer from Baldor's district warehouse or, if applicable, from Baldor's factory. Baldor Standard-E® standard efficient motors are warranted for 24 months. Standard-E is limited to three phase, general purpose, 1-200 HP ratings that fall under the Energy Policy Act (EPA). Baldor Super-E® premium efficient motors are warranted for 36 months. Baldor IEEE841 motors are warranted for 60 months. All warranty claims must be submitted to a Baldor Service Center prior to the expiration of the warranty period.
2. Baldor will, at its option repair or replace a motor which fails due to defects in material or workmanship during the warranty period if:
 - a. the purchaser presents the defective motor at or ships it prepaid to, the Baldor plant in Fort Smith, Arkansas or one of the Baldor Authorized Service Centers and
 - b. the purchaser gives written notification concerning the motor and the claimed defect including the date purchased, the task performed by the Baldor motor and the problem encountered.
3. Baldor will not pay the cost of removal of any electric motor from any equipment, the cost of delivery to Fort Smith, Arkansas or a Baldor Authorized Service Center, or the cost of any incidental or consequential damages resulting from the claimed defects. (Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above exclusion may not apply to you.) Any implied warranty given by laws shall be limited to the duration of the warranty period hereunder. (Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you.)
4. Baldor Authorized Service Centers, when convinced to their satisfaction that a Baldor motor developed defects in material or workmanship within the warranty period, are authorized to proceed with the required repairs to fulfill Baldor's warranty when the cost of such repairs to be paid by Baldor does not exceed Baldor's warranty repair allowance. Baldor will not pay overtime premium repair charges without prior written authorization.
5. The cost of warranty repairs made by centers other than Baldor Authorized Service Centers **WILL NOT** be paid unless first authorized in writing by Baldor.
6. Claims by a purchaser that a motor is defective even when a failure results within one hour after being placed into service are not always justified. Therefore, Baldor Authorized Service Centers must determine from the condition of the motor as delivered to the center whether or not the motor is defective. If in the opinion of a Baldor Authorized Service Center, a motor did not fail as a result of defects in material or workmanship, the center is to proceed with repairs only if the purchaser agrees to pay for such repairs. If the decision is in dispute, the purchaser should still pay for the repairs and submit the paid invoice and the Authorized Service Center's signed service report to Baldor for further consideration.
7. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Safety Notice:

This equipment contains high voltage! Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt installation, operation and maintenance of electrical equipment.

Be sure that you are completely familiar with NEMA publication MG-2, safety standards for construction and guide for selection, installation and use of electric motors and generators, the National Electrical Code and local codes and practices. Unsafe installation or use can cause conditions that lead to serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.

- WARNING:** Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.
- WARNING:** Be sure the system is properly grounded before applying power. Do not apply AC power before you ensure that all grounding instructions have been followed. Electrical shock can cause serious or fatal injury. National Electrical Code and Local codes must be carefully followed.
- WARNING:** Avoid extended exposure to machinery with high noise levels. Be sure to wear ear protective devices to reduce harmful effects to your hearing.
- WARNING:** This equipment may be connected to other machinery that has rotating parts or parts that are driven by this equipment. Improper use can cause serious or fatal injury. Only qualified personnel should attempt to install operate or maintain this equipment.
- WARNING:** Do not by-pass or disable protective devices or safety guards. Safety features are designed to prevent damage to personnel or equipment. These devices can only provide protection if they remain operative.
- WARNING:** Avoid the use of automatic reset devices if the automatic restarting of equipment can be hazardous to personnel or equipment.
- WARNING:** Be sure the load is properly coupled to the motor shaft before applying power. The shaft key must be fully captive by the load device. Improper coupling can cause harm to personnel or equipment if the load decouples from the shaft during operation.
- WARNING:** Use proper care and procedures that are safe during handling, lifting, installing, operating and maintaining operations. Improper methods may cause muscle strain or other harm.
- WARNING:** Before performing any motor maintenance procedure, be sure that the equipment connected to the motor shaft cannot cause shaft rotation. If the load can cause shaft rotation, disconnect the load from the motor shaft before maintenance is performed. Unexpected mechanical rotation of the motor parts can cause injury or motor damage.
- WARNING:** Disconnect all electrical power from the motor windings and accessory devices before disassembly of the motor. Electrical shock can cause serious or fatal injury.
- WARNING:** Do not use non UL/CSA listed explosion proof motors in the presence of flammable or combustible vapors or dust. These motors are not designed for atmospheric conditions that require explosion proof operation.
-

Safety Notice Continued

WARNING: Motors that are to be used in flammable and/or explosive atmospheres must display the UL label on the nameplate along with CSA listed logo.

Specific service conditions for these motors are defined in NFPA 70 (NEC) Article 500.

WARNING: UL Listed motors must only be serviced by UL Approved Authorized Baldor Service Centers if these motors are to be returned to a hazardous and/or explosive atmosphere.

Caution: To prevent premature equipment failure or damage, only qualified maintenance personnel should perform maintenance.

Caution: Do not over-lubricate motor as this may cause premature bearing failure.

Caution: Do not lift the motor and its driven load by the motor lifting hardware. The motor lifting hardware is adequate for lifting only the motor. Disconnect the load from the motor shaft before moving the motor.

Caution: If eye bolts are used for lifting a motor, be sure they are securely tightened. The lifting direction should not exceed a 20° angle from the shank of the eye bolt or lifting lug. Excessive lifting angles can cause damage.

Caution: To prevent equipment damage, be sure that the electrical service is not capable of delivering more than the maximum motor rated amps listed on the rating plate.

Caution: If a HI POT test (High Potential Insulation test) must be performed, follow the precautions and procedure in NEMA MG1 and MG2 standards to avoid equipment damage.

If you have any questions or are uncertain about any statement or procedure, or if you require additional information please contact your Baldor distributor or an Authorized Baldor Service Center.

Receiving

Each Baldor Electric Motor is thoroughly tested at the factory and carefully packaged for shipment. When you receive your motor, there are several things you should do immediately.

1. Observe the condition of the shipping container and report any damage immediately to the commercial carrier that delivered your motor.
2. Verify that the part number of the motor you received is the same as the part number listed on your purchase order.

Storage

If the motor is not put into service immediately, the motor must be stored in a clean, dry and warm location. Several precautionary steps must be performed to avoid motor damage during storage.

1. Use a "Megger" periodically to ensure that the integrity of the winding insulation has been maintained. Record the Megger readings. Immediately investigate any significant drop in insulation resistance.
2. Do not lubricate bearings during storage. Motor bearings are packed with grease at the factory. Excessive grease can damage insulation quality.
3. Rotate motor shaft at least 10 turns every two months during storage (more frequently if possible). This will prevent bearing damage due to storage.
4. If the storage location is damp or humid, the motor windings must be protected from moisture. This can be done by applying power to the motors' space heater (if available) while the motor is in storage.

Unpacking

Each Baldor motor is packaged for ease of handling and to prevent entry of contaminants.

1. To avoid condensation inside the motor, do not unpack until the motor has reached room temperature. (Room temperature is the temperature of the room in which it will be installed). The packing provides insulation from temperature changes during transportation.
2. When the motor has reached room temperature, remove all protective wrapping material from the motor.

Handling

The motor should be lifted using the lifting lugs or eye bolts provided.

1. Use the lugs or eye bolts provided to lift the motor. Never attempt to lift the motor and additional equipment connected to the motor by this method. The lugs or eye bolts provided are designed to lift only the motor. Never lift the motor by the motor shaft or the hood of a WP11 motor.
2. When lifting a WP11 (Weather Proof Type 2) motor, do not lift the motor by inserting lifting lugs into holes on top of the cooling hood. These lugs are to be used for hood removal only. A spreader bar should be used to lift the motor by the cast lifting lugs located on the motor frame.
3. If the motor must be mounted to a plate with the driven equipment such as pump, compressor etc., it may not be possible to lift the motor alone. For this case, the assembly should be lifted by a sling around the mounting base. The entire assembly can be lifted as an assembly for installation. Do not lift using the motor lugs or eye bolts provided.

If the load is unbalanced (as with couplings or additional attachments) additional slings or other means must be used to prevent tipping. In any event, the load must be secure before lifting.

Section 2

Installation & Operation

Overview

Installation should conform to the National Electrical Code as well as local codes and practices. When other devices are coupled to the motor shaft, be sure to install protective devices to prevent future accidents. Some protective devices include, coupling, belt guard, chain guard, shaft covers etc. These protect against accidental contact with moving parts. Machinery that is accessible to personnel should provide further protection in the form of guard rails, screening, warning signs etc.

Location

It is important that motors be installed in locations that are compatible with motor enclosure and ambient conditions. Improper selection of the motor enclosure and ambient conditions can lead to reduced operating life of the motor.

Proper ventilation for the motor must be provided. Obstructed airflow can lead to reduction of motor life.

~~1. **Open Drip Proof/WPI** motors are intended for use indoors where atmosphere is relatively clean, dry, well ventilated and non-corrosive.~~

2. **Totally Enclosed and WPII** motors may be installed where dirt, moisture or dust are present and in outdoor locations.

Severe Duty, IEEE 841 and Washdown Duty enclosed motors are designed for installations with high corrosion or excessive moisture conditions. These motors should not be placed into an environment where there is the presence of flammable or combustible vapors, dust or any combustible material, unless specifically designed for this type of service.

Mounting

The motor must be securely installed to a rigid foundation or mounting surface to minimize vibration and maintain alignment between the motor and shaft load. Failure to provide a proper mounting surface may cause vibration, misalignment and bearing damage.

Foundation caps and sole plates are designed to act as spacers for the equipment they support. If these devices are used, be sure that they are evenly supported by the foundation or mounting surface.

After installation is complete and accurate alignment of the motor and load is accomplished, the base should be grouted to the foundation to maintain this alignment.

The standard motor base is designed for horizontal or vertical mounting. Adjustable or sliding rails are designed for horizontal mounting only. Consult your Baldor distributor or authorized Baldor Service Center for further information.

Alignment

Accurate alignment of the motor with the driven equipment is extremely important.

1. **Direct Coupling**

For direct drive, use flexible couplings if possible. Consult the drive or equipment manufacturer for more information. Mechanical vibration and roughness during operation may indicate poor alignment. Use dial indicators to check alignment. The space between coupling hubs should be maintained as recommended by the coupling manufacturer.

2. **End-Play Adjustment**

The axial position of the motor frame with respect to its load is also extremely important. The motor bearings are not designed for excessive external axial thrust loads. Improper adjustment will cause failure.

3. **Pulley Ratio**

The pulley ratio should not exceed 8:1.

4. **Belt Drive**

Align sheaves carefully to minimize belt wear and axial bearing loads (see End-Play Adjustment). Belt tension should be sufficient to prevent belt slippage at rated speed and load. However, belt slippage may occur during starting.

Caution: Do not over tension belts.

5. Sleeve bearing motors are only suitable for coupled loads.

Doweling & Bolting

After proper alignment is verified, dowel pins should be inserted through the motor feet into the foundation. This will maintain the correct motor position should motor removal be required. (Baldor motors are designed for doweling.)

- 1. Drill dowel holes in diagonally opposite motor feet in the locations provided.
- 2. Drill corresponding holes in the foundation.
- 3. Ream all holes.
- 4. Install proper fitting dowels.
- 5. Mounting bolts must be carefully tightened to prevent changes in alignment. Use a flat washer and lock washer under each nut or bolt head to hold the motor feet secure. Flanged nuts or bolts may be used as an alternative to washers.

Power Connection

Conduit Box

Motor and control wiring, overload protection, disconnects, accessories and grounding should conform to the National Electrical Code and local codes and practices.

For ease of making connections, an oversize conduit box is provided. The box can be rotated 360° in 90° increments. Auxiliary conduit boxes are provided on some motors for accessories such as space heaters, RTD's etc.

AC Power

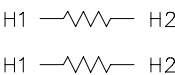
Connect the motor leads as shown on the connection diagram located on the name plate or inside the cover on the conduit box. Be sure the following guidelines are met:

- 1. AC power is within ±10% of rated voltage with rated frequency. (See motor name plate for ratings).
OR
- 2. AC power is within ±5% of rated frequency with rated voltage.
OR
- 3. A combined variation in voltage and frequency of ±10% (sum of absolute values) of rated values, provided the frequency variation does not exceed ±5% of rated frequency.

Performance within these voltage and frequency variations are shown in Figure 2-2.

Figure 2-1 Accessory Connections

HEATERS



One heater is installed in each end of motor.
Leads for each heater are labeled H1 & H2.
(Like numbers should be tied together).

THERMISTERS



Three thermistors are installed in windings and tied in series.
Leads are labeled T1 & T2.

WINDING RTDS



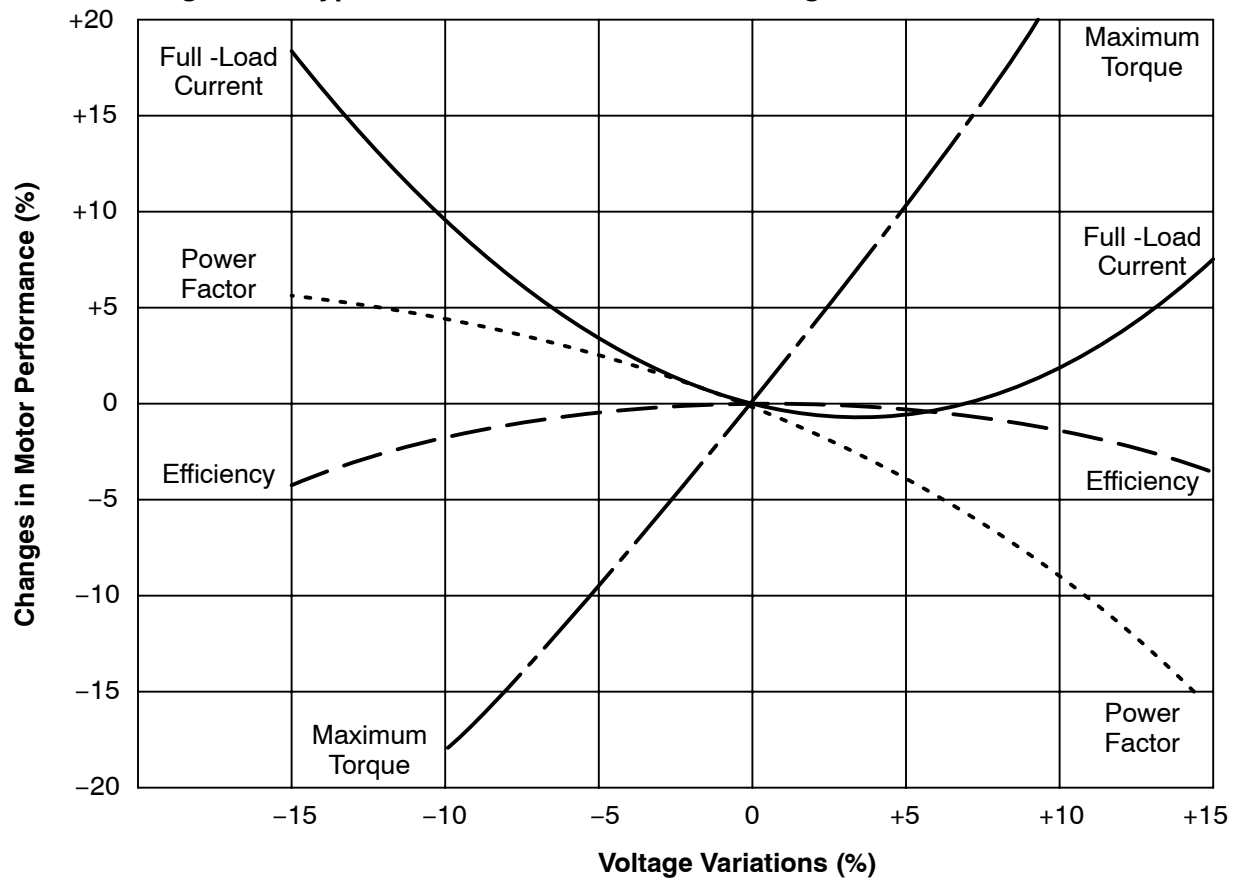
Winding RTDs are installed in windings (2) per phase.
Each set of leads is labeled W1, W2, W3, W4, W5, & W6.

BEARING RTD



- * One bearing RTD is installed in Drive endplate (PUEP), leads are labeled RTDDE.
- * One bearing RTD is installed in Opposite Drive endplate (FREP), leads are labeled RTDODE.
- * Note RTD may have 2–Red/1–White leads; or 2–White/1–Red Lead.

Figure 2-2 Typical Motor Performance VS Voltage Variations



First Time Start Up

Be sure that all power to motor and accessories is off. Be sure the motor shaft is disconnected from the load and will not cause mechanical rotation of the motor shaft.

1. Make sure that the mechanical installation is secure. All bolts and nuts are tightened etc.
2. If motor has been in storage or idle for some time, check winding insulation integrity with a Megger.
3. Inspect all electrical connections for proper termination, clearance, mechanical strength and electrical continuity.
4. Be sure all shipping materials and braces (if used) are removed from motor shaft.
5. Manually rotate the motor shaft to ensure that it rotates freely.
6. Replace all panels and covers that were removed during installation.
7. Momentarily apply power and check the direction of rotation of the motor shaft.
8. If motor rotation is wrong, be sure power is off and change the motor lead connections. Verify rotation direction before you continue.
9. Start the motor and ensure operation is smooth without excessive vibration or noise. If so, run the motor for 1 hour with no load connected.
10. After 1 hour of operation, disconnect power and connect the load to the motor shaft. Verify all coupling guards and protective devices are installed. Ensure motor is properly ventilated.

Coupled Start Up

This procedure assumes a coupled start up. Also, that the first time start up procedure was successful.

1. Check the coupling and ensure that all guards and protective devices are installed.
2. Check that the coupling is properly aligned and not binding.
3. The first coupled start up should be with no load. Apply power and verify that the load is not transmitting excessive vibration back to the motor through the coupling or the foundation. Vibration should be at an acceptable level.
4. Run for approximately 1 hour with the driven equipment in an unloaded condition.

The equipment can now be loaded and operated within specified limits. Do not exceed the name plate ratings for amperes for steady continuous loads.

Jogging and Repeated Starts Repeated starts and/or jogs of induction motors generally reduce the life of the motor winding insulation. A much greater amount of heat is produced by each acceleration or jog than by the same motor under full load. If it is necessary to repeatedly start or jog the motor, it is advisable to check the application with your local Baldor distributor or Baldor Service Center.

Heating - Duty rating and maximum ambient temperature are stated on the motor name plate. Do not exceed these values. If there is any question regarding safe operation, contact your local Baldor distributor or Baldor Service Center.

Section 3

Maintenance & Troubleshooting

WARNING: UL Listed motors must only be serviced by UL Approved Authorized Baldor Service Centers if these motors are to be returned to a hazardous and/or explosive atmosphere.

General Inspection

Inspect the motor at regular intervals, approximately every 500 hours of operation or every 3 months, whichever occurs first. Keep the motor clean and the ventilation openings clear. The following steps should be performed at each inspection:

WARNING: Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.

1. Check that the motor is clean. Check that the interior and exterior of the motor is free of dirt, oil, grease, water, etc. Oily vapor, paper pulp, textile lint, etc. can accumulate and block motor ventilation. If the motor is not properly ventilated, overheating can occur and cause early motor failure.
2. Use a "Megger" periodically to ensure that the integrity of the winding insulation has been maintained. Record the Megger readings. Immediately investigate any significant drop in insulation resistance.
3. Check all electrical connectors to be sure that they are tight.

Relubrication & Bearings

Bearing grease will lose its lubricating ability over time, not suddenly. The lubricating ability of a grease (over time) depends primarily on the type of grease, the size of the bearing, the speed at which the bearing operates and the severity of the operating conditions. Good results can be obtained if the following recommendations are used in your maintenance program.

Type of Grease

A high grade ball or roller bearing grease should be used. Recommended grease for standard service conditions is Polyrex EM (Exxon Mobil).

Equivalent and compatible greases include:

Texaco Polystar, Rykon Premium #2, Pennzoil Pen 2 Lube and Chevron SRI.

Relubrication Intervals

Recommended relubrication intervals are shown in Table 3-1. It is important to realize that the recommended intervals of Table 3-1 are based on average use.

Refer to additional information contained in Tables 3-2, 3-3 and 3-4.

Table 3-1 Relubrication Intervals *

NEMA / (IEC) Frame Size	Rated Speed - RPM					
	1800	900	600	1800	1200	900
Up to 210 incl. (132)	**	2700 Hrs.	5500 Hrs.	12000 Hrs.	18000 Hrs.	22000 Hrs.
Over 210 to 280 incl. (180)		"	3000 Hrs.	9500 Hrs.	15000 Hrs.	18000 Hrs.
Over 280 to 360 incl. (225)		"	2200 Hrs.	7400 Hrs.	12000 Hrs.	15000 Hrs.
Over 360 to 560 incl. (360)		"	2200 Hrs.	3500 Hrs.	7400 Hrs.	10500 Hrs.

* Relubrication intervals are for ball bearings.

For vertically mounted motors and roller bearings, divide the relubrication interval by 2.

** For motors operating at speeds greater than 3600 RPM, contact Baldor for relubrication recommendations.

Table 3-2 Service Conditions

Severity of Service	Hours per day of Operation	Ambient Temperature Maximum	Atmospheric Contamination
Standard	8	40° C	Clean, Little Corrosion
Severe	16 Plus	50° C	Moderate dirt, Corrosion
Extreme	16 Plus	>50° C* or Class H Insulation	Severe dirt, Abrasive dust, Corrosion, Heavy Shock or Vibration
Low Temperature		<-29° C **	

* Special high temperature grease is recommended (Dow Corning DC44). Note that Dow Corning DC44 grease does not mix with other grease types. Thoroughly clean bearing & cavity before adding grease.

** Special low temperature grease is recommended (Aeroshell 7).

Table 3-3 Relubrication Interval Multiplier

Severity of Service	Multiplier
Standard	1.0
Severe	0.5
Extreme	0.1
Low Temperature	1.0

Some motor designs use different bearings on each motor end. This is normally indicated on the motor nameplate. In this case, the larger bearing is installed on the motor Drive endplate. For best relubrication results, only use the appropriate amount of grease for each bearing size (not the same for both).

Table 3-4 Bearings Sizes and Types

Frame Size NEMA (IEC)	Bearing Description (These are the "Large" bearings (Shaft End) in each frame size)			
	Bearing	Weight of Grease to add * oz (Grams)	Volume of grease to be added	
			in ³	teaspoon
56 to 140 (90)	6203	0.08 (2.4)	0.15	0.5
140 (90)	6205	0.15 (3.9)	0.2	0.8
180 (100-112)	6206	0.19 (5.0)	0.3	1.0
210 (132)	6207	0.30 (8.1)	0.6	2.0
250 (160)	6309	0.47 (12.5)	0.7	2.5
280 (180)	6311	0.61 (17)	1.2	3.9
320 (200)	6312	0.76 (20.1)	1.2	4.0
360 (225)	6313	0.81 (23)	1.5	5.2
400 (250)	6316	1.25 (35)	2.0	6.6
440 (280)	6319	2.12 (60)	4.1	13.4
5000 to 5800 (315-450)	6328	4.70 (130)	9.2	30.0
5000 to 5800 (315-450)	NU328	4.70 (130)	9.2	30.0
360 to 449 (225-280)	NU319	2.12 (60)	4.1	13.4
AC Induction Servo				
76 Frame 180 (112)	6207	0.22 (6.1)	0.44	1.4
77 Frame 210 (132)	6210	0.32 (9.0)	0.64	2.1
80 Frame 250 (160)	6213	0.49 (14.0)	0.99	3.3

* Weight in grams = .005 DB of grease to be added

Note: Not all bearing sizes are listed. For intermediate bearing sizes, use the grease volume for the next larger size bearing.

Caution: To avoid damage to motor bearings, grease must be kept free of dirt. For an extremely dirty environment, contact your Baldor distributor or an authorized Baldor Service Center for additional information.

Relubrication Procedure Be sure that the grease you are adding to the motor is compatible with the grease already in the motor. Consult your Baldor distributor or an authorized service center if a grease other than the recommended type is to be used.

Caution: Do not over-lubricate motor as this may cause premature bearing failure.

With Grease Outlet Plug

1. With the motor stopped, clean all grease fittings with a clean cloth.
2. Remove grease outlet plug.

Caution: Over-lubricating can cause excessive bearing temperatures, premature lubrication breakdown and bearing failure.

3. Add the recommended amount of grease.
4. Operate the motor for 15 minutes with grease plug removed. This allows excess grease to purge.
5. Re-install grease outlet plug.

Without Grease Provisions

Note: Only a Baldor authorized and UL or CSA certified service center can disassemble a UL/CSA listed explosion proof motor to maintain it's UL/CSA listing.

1. Disassemble the motor.
2. Add recommended amount of grease to bearing and bearing cavity. (Bearing should be about 1/3 full of grease and outboard bearing cavity should be about 1/2 full of grease.)
3. Assemble the motor.

Sample Relubrication Determination

Assume - NEMA 286T (IEC 180), 1750 RPM motor driving an exhaust fan in an ambient temperature of 43° C and the atmosphere is moderately corrosive.

1. Table 3-1 list 9500 hours for standard conditions.
2. Table 3-2 classifies severity of service as "Severe".
3. Table 3-4 shows that 1.2 in³ or 3.9 teaspoon of grease is to be added.

Note: Smaller bearings in size category may require reduced amounts of grease.

Table 3-5 Troubleshooting Chart

Symptom	Possible Causes	Possible Solutions
Motor will not start	Usually caused by line trouble, such as, single phasing at the starter.	Check source of power. Check overloads, fuses, controls, etc.
Excessive humming	High Voltage.	Check input line connections.
	Eccentric air gap.	Have motor serviced at local Baldor service center.
Motor Over Heating	Overload. Compare actual amps (measured) with nameplate rating.	Locate and remove source of excessive friction in motor or load. Reduce load or replace with motor of greater capacity.
	Single Phasing.	Check current at all phases (should be approximately equal) to isolate and correct the problem.
	Improper ventilation.	Check external cooling fan to be sure air is moving properly across cooling fins. Excessive dirt build-up on motor. Clean motor.
	Unbalanced voltage.	Check voltage at all phases (should be approximately equal) to isolate and correct the problem.
	Rotor rubbing on stator.	Check air gap clearance and bearings.
		Tighten "Thru Bolts".
	Over voltage or under voltage.	Check input voltage at each phase to motor.
	Open stator winding.	Check stator resistance at all three phases for balance.
	Grounded winding.	Perform dielectric test and repair as required.
	Improper connections.	Inspect all electrical connections for proper termination, clearance, mechanical strength and electrical continuity. Refer to motor lead connection diagram.
Bearing Over Heating	Misalignment.	Check and align motor and driven equipment.
	Excessive belt tension.	Reduce belt tension to proper point for load.
	Excessive end thrust.	Reduce the end thrust from driven machine.
	Excessive grease in bearing.	Remove grease until cavity is approximately $\frac{3}{4}$ filled.
	Insufficient grease in bearing.	Add grease until cavity is approximately $\frac{3}{4}$ filled.
	Dirt in bearing.	Clean bearing cavity and bearing. Repack with correct grease until cavity is approximately $\frac{3}{4}$ filled.
Vibration	Misalignment.	Check and align motor and driven equipment.
	Rubbing between rotating parts and stationary parts.	Isolate and eliminate cause of rubbing.
	Rotor out of balance.	Have rotor balance checked and repaired at your Baldor Service Center.
	Resonance.	Tune system or contact your Baldor Service Center for assistance.
Noise	Foreign material in air gap or ventilation openings.	Remove rotor and foreign material. Reinstall rotor. Check insulation integrity. Clean ventilation openings.
Growling or whining	Bad bearing.	Replace bearing. Clean all grease from cavity and new bearing. Repack with correct grease until cavity is approximately $\frac{3}{4}$ filled.

Suggested bearing and winding RTD setting guidelines

Most large frame AC Baldor motors with a 1.15 service factor are designed to operate below a Class B (80°C) temperature rise at rated load and are built with a Class H winding insulation system. Based on this low temperature rise, RTD (Resistance Temperature Detectors) settings for Class B rise should be used as a starting point. Some motors with 1.0 service factor have Class F temperature rise.

The following tables show the suggested alarm and trip settings for RTDs. Proper bearing and winding RTD alarm and trip settings should be selected based on these tables unless otherwise specified for specific applications.

If the driven load is found to operate well below the initial temperature settings under normal conditions, the alarm and trip settings may be reduced so that an abnormal machine load will be identified.

The temperature limits are based on the installation of the winding RTDs imbedded in the winding as specified by NEMA. Bearing RTDs should be installed so they are in contact with the outer race on ball or roller bearings or in direct contact with the sleeve bearing shell.

Winding RTDs – Temperature Limit In °C (40°C Maximum Ambient)

Motor Load	Class B Temp Rise ≤ 80°C (Typical Design)		Class F Temp Rise ≤ 105°C		Class H Temp Rise ≤ 125°C	
	Alarm	Trip	Alarm	Trip	Alarm	Trip
≤ Rated Load	130	140	155	165	175	185
Rated Load to 1.15 S.F.	140	150	160	165	180	185

Note: • Winding RTDs are factory production installed, not from Mod-Express.

• When Class H temperatures are used, consider bearing temperatures and relubrication requirements.

Bearing RTDs – Temperature Limit In °C (40°C Maximum Ambient)

Bearing Type Oil or Grease	Anti-Friction		Sleeve	
	Alarm	Trip	Alarm	Trip
Standard*	95	100	85	95
High Temperature**	110	115	105	110

Note: * Bearing temperature limits are for standard design motors operating at Class B temperature rise.

** High temperature lubricants include some special synthetic oils and greases.

Greases that may be substituted that are compatible with Polyrex EM (but considered as "standard" lubricants) include the following:

- | | | |
|--------------------|---------------------------|-----------------------------|
| – Texaco Polystar | – Rykon Premium #2 | – Chevron SRI #2 |
| – Mobilith SHC-100 | – Pennzoil Pennzlube EM-2 | – Chevron Black Pearl |
| – Darmex 707 | – Darmex 711 | – Petro-Canada Peerless LLG |

See the motor nameplate for replacement grease or oil recommendation.

Contact Baldor application engineering for special lubricants or further clarifications.

Baldor District Offices Baldor District Offices Baldor District Offices

UNITED STATES

ARIZONA

PHOENIX

4211 S 43RD PLACE
PHOENIX, AZ 85040
PHONE: 602 470 0407
FAX: 602 470 0464

ARKANSAS

CLARKSVILLE

1001 COLLEGE AVE.
CLARKSVILLE, AR 72830
PHONE: 479 754 9108
FAX: 479 754 9205

CALIFORNIA

LOS ANGELES

6480 FLOTILLA
COMMERCE, CA 90040
PHONE: 323 724 6771
FAX: 323 721 5859

HAYWARD

21056 FORBES STREET
HAYWARD, CA 94545
PHONE: 510 785 9900
FAX: 510 785 9910

COLORADO

DENVER

2520 W BARBERRY PLACE
DENVER, CO 80204
PHONE: 303 623 0127
FAX: 303 595 3772

CONNECTICUT

WALLINGFORD

65 SOUTH TURNPIKE ROAD
WALLINGFORD, CT 06492
PHONE: 203 269 1354
FAX: 203 269 5485

FLORIDA

TAMPA/PUERTO RICO/ VIRGIN ISLANDS

3906 EAST 11TH AVENUE
TAMPA, FL 33605
PHONE: 813 248 5078
FAX: 813 247 2984

GEORGIA

ATLANTA

62 TECHNOLOGY DR.
ALPHARETTA, GA 30005
PHONE: 770 772 7000
FAX: 770 772 7200

ILLINOIS

CHICAGO

1601 FRONTENAC ROAD
NAPERVILLE, IL 60563
PHONE: 630 848 5100
FAX: 630 848 51 10

INDIANA

INDIANAPOLIS

5525 W. MINNESOTA STREET
INDIANAPOLIS, IN 46241
PHONE: 317 246 5100
FAX: 317 246 51 10

IOWA

DES MOINES

1800 DIXON STREET, SUITE C
DES MOINES, IA 50316
PHONE: 515 263 6929
FAX: 515 263 6515

MARYLAND

BALTIMORE

6660 SANTA BARBARA RD.
SUITE 22 24
ELKBRIDGE, MD 21075
PHONE: 410 579 2135
FAX: 410 579 2677

MASSACHUSETTS

BOSTON

6 PULLMAN STREET
WORCESTER, MA 01606
PHONE: 508 854 0708
FAX: 508 854 0291

MICHIGAN

DETROIT

33782 STERLING PONDS BLVD.
STERLING HEIGHTS, MI 48312
PHONE: 586 978 9800
FAX: 586 978 9969

GRAND RAPIDS

668 THREE MILE ROAD NW
GRAND RAPIDS, MI 49504
PHONE: 616 785 1784
FAX: 616 785 1788

MINNESOTA

MINNEAPOLIS

21080 134TH AVE. NORTH
ROGERS, MN 55374
PHONE: 763 428 3633
FAX: 763 428 4551

MISSOURI

ST LOUIS

422 INDUSTRIAL DRIVE
MARYLAND HEIGHTS, MO 63043
PHONE: 314 298 1800
FAX: 314 298 7660

KANSAS CITY

1501 BEDFORD AVENUE
NORTH KANSAS CITY, MO 64116
PHONE: 816 587 0272
FAX: 816 587 3735

NEW YORK

AUBURN

ONE ELLIS DRIVE
AUBURN, NY 13021
PHONE: 315 255 3403
FAX: 315 253 9923

NORTH CAROLINA

GREENSBORO

1220 ROTHERWOOD ROAD
GREENSBORO, NC 27406
P O BOX 16500
GREENSBORO, NC 27416
PHONE: 336 272 6104
FAX: 336 273 6628

OHIO

CINCINNATI

2929 CRESCENTVILLE ROAD
WEST CHESTER, OH 45069
PHONE: 513 771 2600
FAX: 513 772 2219

CLEVELAND

8929 FREEWAY DRIVE
MACEDONIA, OH 44056
PHONE: 330 468 4777
FAX: 330 468 4778

OKLAHOMA

TULSA

2 EAST DAWES
BIXBY, OK 74008
PHONE: 918 366 9320
FAX: 918 366 9338

OREGON

PORTLAND

20393 SW AVERY COURT
TUALATIN, OR 97062
PHONE: 503 691 9010
FAX: 503 691 9012

PENNSYLVANIA

PHILADELPHIA

1035 THOMAS BUSCH
MEMORIAL HIGHWAY
PENNSAUKEN, NJ 08110
PHONE: 856 661 1442
FAX: 856 663 6363

PITTSBURGH

159 PROMINENCE DRIVE
NEW KENSINGTON, PA 15068
PHONE: 724 889 0092
FAX: 724 889 0094

TENNESSEE

MEMPHIS

4000 WINCHESTER ROAD
MEMPHIS, TN 38118
PHONE: 901 365 2020
FAX: 901 365 3914

TEXAS

HOUSTON

4647 PINE TIMBERS
SUITE # 135
HOUSTON, TX 77041
PHONE: 713 895 7062
FAX: 713 690 4540

DALLAS

3040 QUEBEC
DALLAS, TX 75247
PHONE: 214 634 7271
FAX: 214 634 8874

UTAH

SALT LAKE CITY

2230 SOUTH MAIN STREET
SALT LAKE CITY, UT 84115
PHONE: 801 832 0127
FAX: 801 832 891 1

WISCONSIN

MILWAUKEE

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NEW BERLIN, WI 53151
PHONE: 262 784 5940
FAX: 262 784 1215

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P.O. BOX 2400
FORT SMITH, AR 72902
PHONE: 479 646 471 1
FAX: 479 648 5895

CANADA

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4053 92 STREET
EDMONTON, ALBERTA T6E 6R8
PHONE: 780 434 4900
FAX: 780 438 2600

OAKVILLE, ONTARIO

2750 COVENTRY ROAD
OAKVILLE, ONTARIO L6H 6R1
PHONE: 905 829 3301
FAX: 905 829 3302

MONTREAL, QUEBEC

1844 WILLIAM STREET
MONTREAL, QUEBEC H3J 1R5
PHONE: 514 933 271 1
FAX: 514 933 8639

VANCOUVER,

BRITISH COLUMBIA

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PORT COQUITLAM, BC V3C 5M5
PHONE 604 421 2822
FAX: 604 421 31 13

WINNIPEG, MANITOBA

54 PRINCESS STREET
WINNIPEG, MANITOBA R3B 1K2
PHONE: 204 942 5205
FAX: 204 956 4251

AUSTRALIA

UNIT 3, 6 STANTON ROAD
SEVEN HILLS, NSW 2147,
AUSTRALIA
PHONE: (61) (2) 9674 5455
FAX: (61) (2) 9674 2495

UNIT 8, 5 KELLETTS ROAD
ROWVILLE, VICTORIA, 3178
AUSTRALIA
PHONE: (61) (3) 9753 4355
FAX: (61) (3) 9753 4366

AMÉRICA DEL SUR

APTDO. 0818 00440
CIUDAD DE PANAMÁ, PANAMÁ
PHONE: +507 261 5347
FAX: +507 261 5355

CENTRO AMÉRICA Y CARIBE

RESIDENCIAL PINARES DE SUIZA
POL. 15 #44,
NVA. SAN SALVADOR, EL SALVADOR
PHONE: +503 2288 1519
FAX: +503 2288 1518

CHINA

ROOM NO. A 8421,
JIAHUA BUSINESS CENTER
808 HONG QIAO ROAD
SHANGHAI 200030, CHINA
PHONE: (86 21) 6447 3060
FAX: (86 21) 6407 8620

GERMANY

DIESELSTRASSE 22
D 85551 KIRCHHEIM
MUNICH, GERMANY
PHONE: +49 89 90 5080
FAX: +49 89 90 50 8492

INDIA

14, COMMERCE AVENUE
MAHAGANESH COLONY
RAUD ROAD
PUNE 411 038
MAHARASHTRA, INDIA
PHONE: 91 20 25 45 95 31
FAX: 91 20 25 45 95 30

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CH 6850 MENDRISIO
SWITZERLAND
PHONE: 0041 91 640 99 50
FAX: 0041 91 630 26 33

JAPAN

DIA BLDG 802,
2 21 1 TSURUY A CHO,
KANAGAWA KU
YOKOHAMA, 221 0835, JAPAN
PHONE: 81 45 412 4506
FAX: 81 45 412 4507

KOREA

ROOM 208 37
INCHEON INDUSTRIAL GOODS
CIRCULATING CENTER
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INCHEON, KOREA, 401 705
PHONE: (82) 32 588 3253
FAX: (82) 32 588 3254

MÉXICO

KM. 2.0 BLVD. AL AEROPUERTO
LEÓN 37545, GUANAJUATO,
MÉXICO
PHONE: 52 477 761 2030
FAX: 52 477 761 2010

MIDDLE EAST & NORTH AFRICA

VSE INTERNATIONAL CORP.
3233 NORTH ARLINGTON HEIGHTS
SUITE 100W
ARLINGTON HEIGHTS, IL 60004
PHONE: 847 590 5547
FAX: 847 590 5587

SINGAPORE

51 KAKI BUKIT ROAD
2 KB WAREHOUSE COMPLEX
SINGAPORE 417863
PHONE: (65) 6744 2572
FAX: (65) 6747 1708

SWITZERLAND

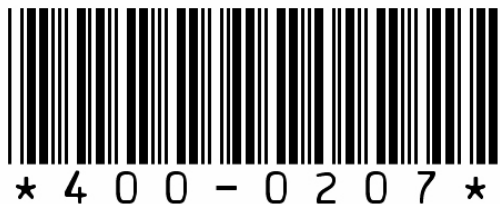
POSTFACH 73
SCHUTZENSTRASSE 59
CH 8245 FEUER THALEN
SWITZERLAND
PHONE: +41 52 647 4700
FAX: +41 52 659 2394

TAIWAN

1F, NO 126 WENSHAN 3RD STREET,
NANTUN DISTRICT, TAICHUNG CITY 408
TAIWAN R.O.C
PHONE: (886) 4 238 04235
FAX: (886) 4 238 04463

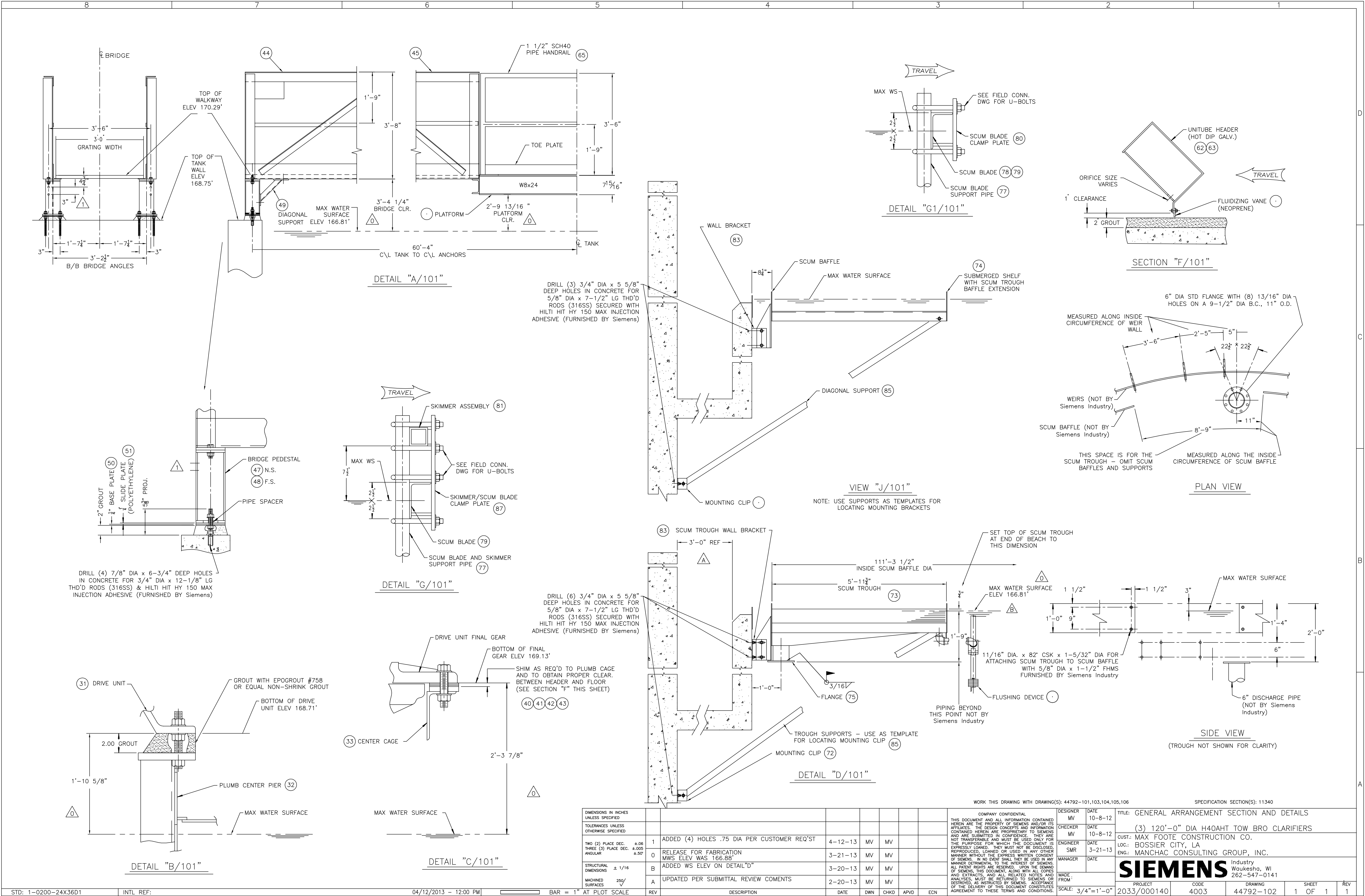
UNITED KINGDOM

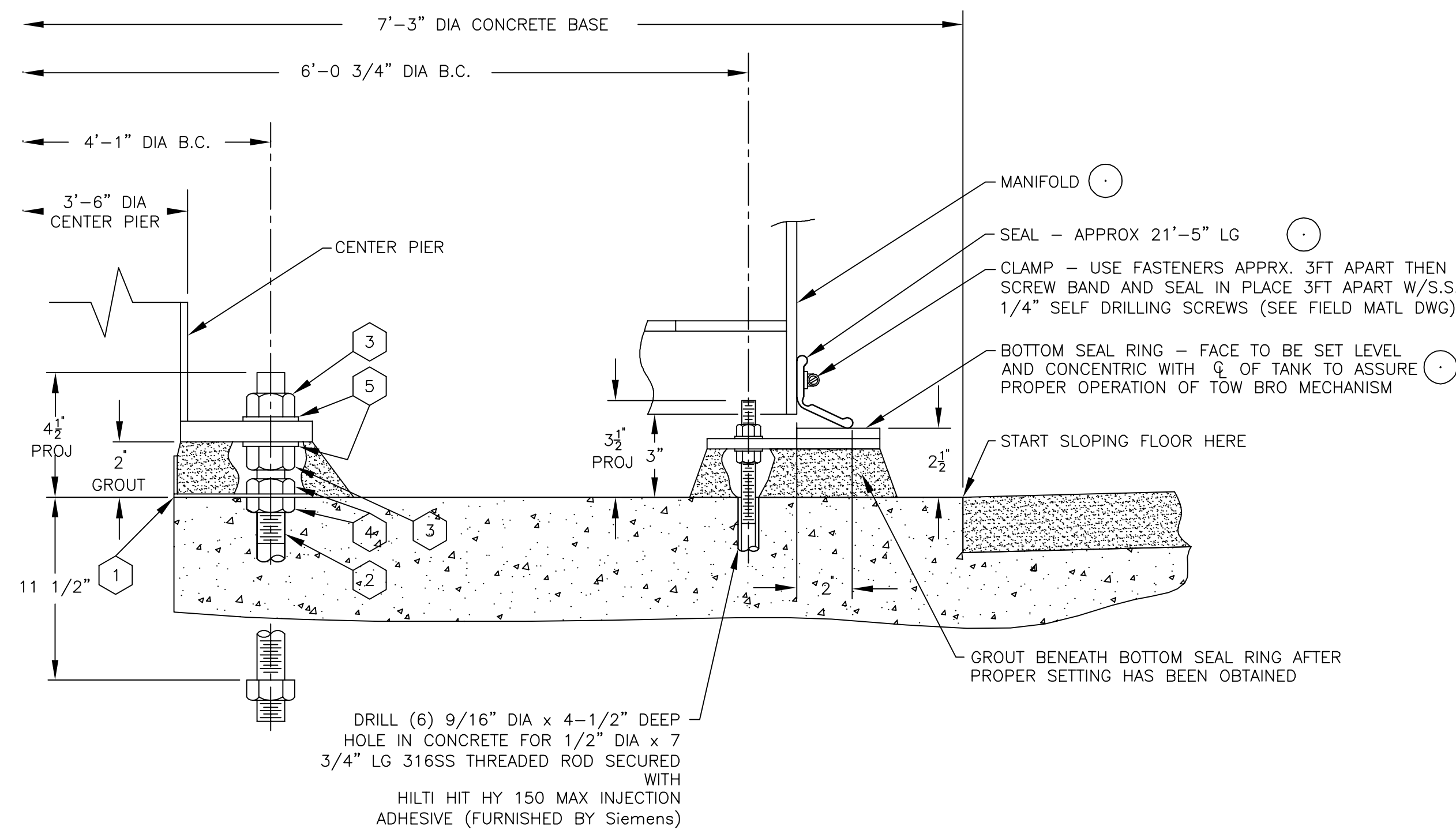
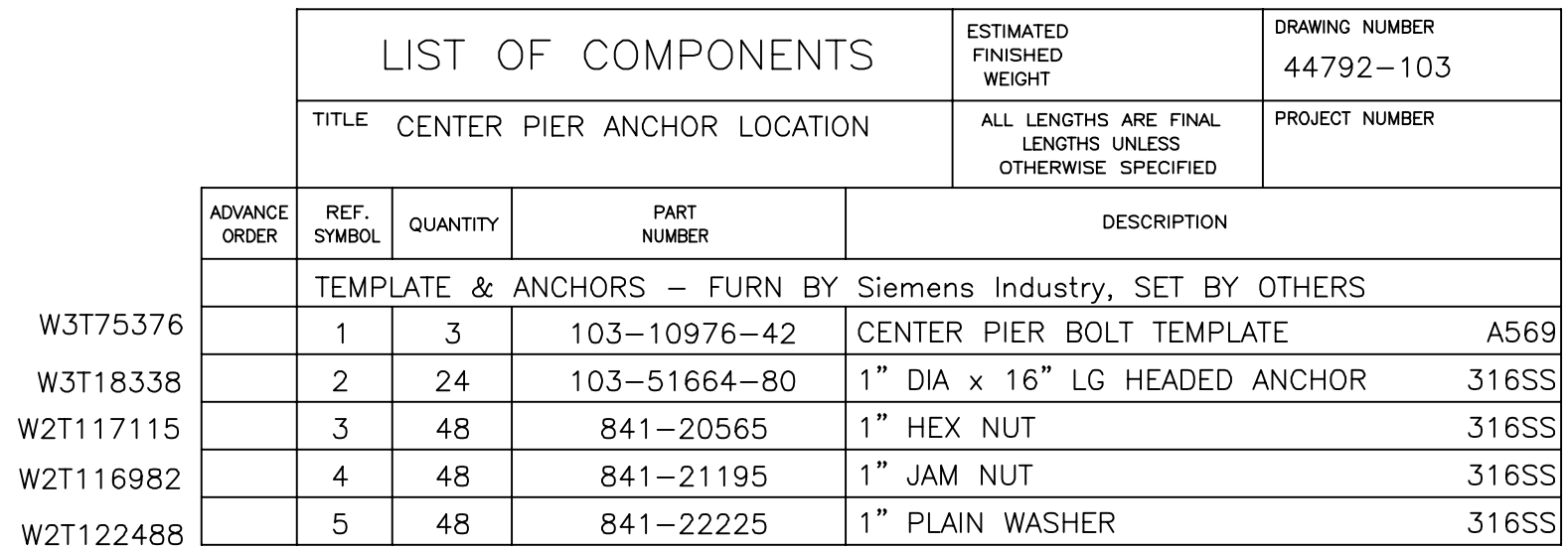
6 BRISTOL DISTRIBUTION PARK
HAWKLEY DRIVE
BRISTOL BS32 0BF U.K.
PHONE: +44 1454 850000
FAX: +44 1454 859001




BALDOR ELECTRIC COMPANY
P.O. Box 2400
Ft. Smith, AR 72902-2400
(479) 646-4711
Fax (479) 648-5792
www.baldor.com

<div> <div>1</div> <div>SIEMENS</div> <div>O&M List of Materials</div> </div>							
DESCRIPTION (3) H40A-HT, 120' DIA CIRC. CLARIFIER				PROJECT: 44792-01			
CUSTOMER: customer MAX FOOT CONSTRUCTION CO				SAP No: 2033/000140			
LOCATION: BOSSIER, LA				Released By/Date			
ITEM	QTY.	WT PART NO.	LEGACY/DWG NO.	DESCRIPTION	WGT	O+M	
31	3	44792-107	W3T260811	H40A-HT DRIVE ASSEMBLY	5502	+	
32	3	44792-109-100		42" DIA CENTER PIER	2548	-	
33	3	44792-110-100		CENTER CAGE W/ FEDWA	1807	-	
34	3	503-41141-81		BOTTOM SEAL RING	119	-	
35	3	503-82646-80		MANIFOLD	1803	-	
36	117FT	103-81481-1		MANIFOLD SEAL (NEOPRENE)	20	-	
37	12	103-51567-1		SHIM - 14 GA (CAGE TO MANIFOLD)	4	-	
38	12	103-51567-2		SHIM - 10 GA (CAGE TO MANIFOLD)	7		
39	12	103-51567-3		SHIM - 3/16" (CAGE TO MANIFOLD)	10		
40	12	CA3067-100		SHIM - 1/2" (CAGE TO DRIVE)	14		
41	12	CA3067-100		SHIM - 1/2" (CAGE TO DRIVE)	14	-	
42	12	CA3067-200		SHIM - 1/4" (CAGE TO DRIVE)	7		
43	12	CA3067-300		SHIM - 10 GA (CAGE TO DRIVE)	4		
44	24	CA3067-400		SHIM - 14 GA (CAGE TO DRIVE)	3		
45	3	503-82722-81		BRIDGE RIM SECTION	2098	-	
46	3	503-82732-80		PLATFORM	842	-	
47	3	44792-111-100		PEDESTAL L.H	8	-	
48	3	44792-111-101		PEDESTAL R.H.	1		
49	6	44792-111-102		BRIDGE KNEE BRACE	113	-	
50	6	43379-126-1		BRIDGE BASE PLATE	8	-	
51	6	43379-126-2		BRIDGE SLIDE PLATE POLYETHYLENE	1	-	
52	3	503-2374-83		WALKWAY EXTENSION	113	-	
53	12	44792-113-100		FEDWA PRIMARY BAFFLE	676	-	
54	12	503-83221-106		FEDWA SECONDARY BAFFLE	1404	-	
55	24	103-10969-1		FEDWA SUPPORT CLIP - PRIMARY	16	-	
56	24	103-10969-7		FEDWA SUPPORT CLIP - SECONDARY	56	-	
57	6	503-83217-86		FEDWA SUPPORT UPPER	960	-	
58	6	503-83217-96		FEDWA SUPPORT LOWER	964	-	
59	12	503-82693-80		INFLUENT WELL SECTION	2472	-	
60	3	44792-108-100	W3T261181	FIELD MATERIAL	0	+	
61	3	303-80291-13		GRATING SECTION (ALUM)	66	-	
62	54	303-80291-21		GRATING SECTION (ALUM)	524		
63	6	303-80291-79	W3T261808	GRATING SECTION (ALUM)	354		
64	300	303-80291-83	W2T120299	GRATING CLIPS (ALUM)	2		
65	3	44792-112-100	W3T261356	HANDRAILING ASSEMBLY (ALUM)	381	-	
66	3	503-41496-80		TIE BAR ATTACHMENT	15	-	
67	186FT	103-51353-1		NEOPRENE FLUIDIZING VANE	3	-	
68	3	503-82662-85		DEFLECTOR BLADE	66	-	
69	3	503-82630-80		TRUSS	1661	-	
70	3	503-82660-83		TIE CHORD A-FRAME	129	-	
71	30	103-81644-1		COUNTERWEIGHTS	500	-	
72	36	103-10815-2		SCUM TROUGH/A-FRAME MOUNTING CLIP	7	-	
73	3	503-81922-90		SCUM TROUGH	541	-	
74	3	503-82156-88		6'-0" BAFFLE EXTENSION w/SHELF	362	-	
75	3	103-50470-1		6" SCUM TROUGH FLANGE	7	-	
76	12	503-82661-83		A-FRAME SUPPORT ASSEMBLY	500	-	
77	12	503-41494-82		SCUM BLADE & SKIMMER SUPPORT PIPE	96	-	
78	3	503-2910-81		SCUM BLADE OUTER	210	-	
79	3	44792-114-100		SCUM BLADE ASSY	47	-	
80	6	503-2908-80		SCUM BLADE CLAMP PLATE	16	-	
81	3	603-81246-80		6'-0" SKIMMER ASSY	182	+	
82	3	503-3043-81		6" DRAIN PLUG	8	-	
83	9	103-81107-1		SCUM TROUGH WALL BRACKET	17	-	
84	6	103-10818-66		TIE BARS	102	-	
85	9	42578-121-1		SCUM TROUGH SUPPORT ANGLE	178	-	
86	3	503-81935-80		FLUSHING DEVICE	47	+	
87	6	503-2908-81		SCIMMER/SCUM BLADE CLAMP [PLATE	30	-	
88	3	103-278-8		COUNTERWEIGHT BRACKET	77	-	
89	12	503-82693-82		INFLUENT WELL SECTION	2028	-	
90	24	103-309-1		CORNER SPL	304	-	
91	3	44290-116-100		HEADER ASSEMBLY	2342	-	
92	3	44290-116-101		HEADER ASSEMBLY	1618	-	
93	6	103-10818-49		TIE BARS	88	-	
94	3	603-20555-82	W2T317936	FIELD MATERIAL - FEDWA			





DIMENSIONS IN INCHES UNLESS SPECIFIED										COMPANY CONFIDENTIAL THIS DOCUMENT AND ALL INFORMATION CONTAINED HEREIN ARE THE PROPERTY OF SIEMENS AND/OR ITS AFFILIATES. THE DESIGN CONCEPTS AND INFORMATION CONTAINED HEREIN ARE PROPRIETARY TO SIEMENS AND ARE SUBMITTED IN CONFIDENCE. THEY NOT TRANSFERABLE AND MUST BE USED ONLY FOR THE PURPOSE FOR WHICH THE DOCUMENT EXPRESSLY LOANED. THEY MUST NOT BE DISCLOSED, REPRODUCED, LOANED OR USED IN ANY OTHER MANNER WITHOUT THE EXPRESS WRITTEN CONSENT OF SIEMENS. IN NO EVENT SHALL THEY BE USED IN AN MANNER DETRIMENTAL TO THE INTEREST OF SIEMENS ALL PATENT RIGHTS ARE RESERVED. UPON THE DEMAND OF SIEMENS, THIS DOCUMENT, ALONG WITH ALL COPIES AND EXTRACTS, AND ALL RELATED NOTES AND ANALYSES, MUST BE RETURNED TO SIEMENS DESTROYED, AS INSTRUCTED BY SIEMENS. ACCEPTANCE OF THE DELIVERY OF THIS DOCUMENT CONSTITUTES AGREEMENT TO THESE TERMS AND CONDITIONS.		DESIGNER MV	DATE 10-17-12	TITLE: GENERAL ARRANGEMENT CENTER PIER DETAILS (3) 120'-0" DIA H40AHT TOW BRO CLARIFIERS CUST.: MAX FOOTE CONSTRUCTION CO. LOC.: BOSSIER CITY, LA ENG.: MANCHAC CONSULTING GROUP, INC.				
TOLERANCES UNLESS OTHERWISE SPECIFIED										CHECKER MV	DATE 10-17-12							
TWO (2) PLACE DEC. ±.06 THREE (3) PLACE DEC. ±.005 ANGULAR ±.50°										ENGINEER	DATE							
STRUCTURAL DIMENSIONS ± 1/16										MANAGER	DATE							
MACHINED SURFACES 250/ ✓												MADE FROM  Industry Waukesha, WI 262-457-0141						
AT PLOT SCALE		REV	DESCRIPTION	3-21-13	MV	MV												
				DATE	DWN	CHKD	APVD	ECN										
									PROJECT 2033/000140	CODE 4003	DRAWING 44792-103	SHEET 1	OF 1	REV 0				

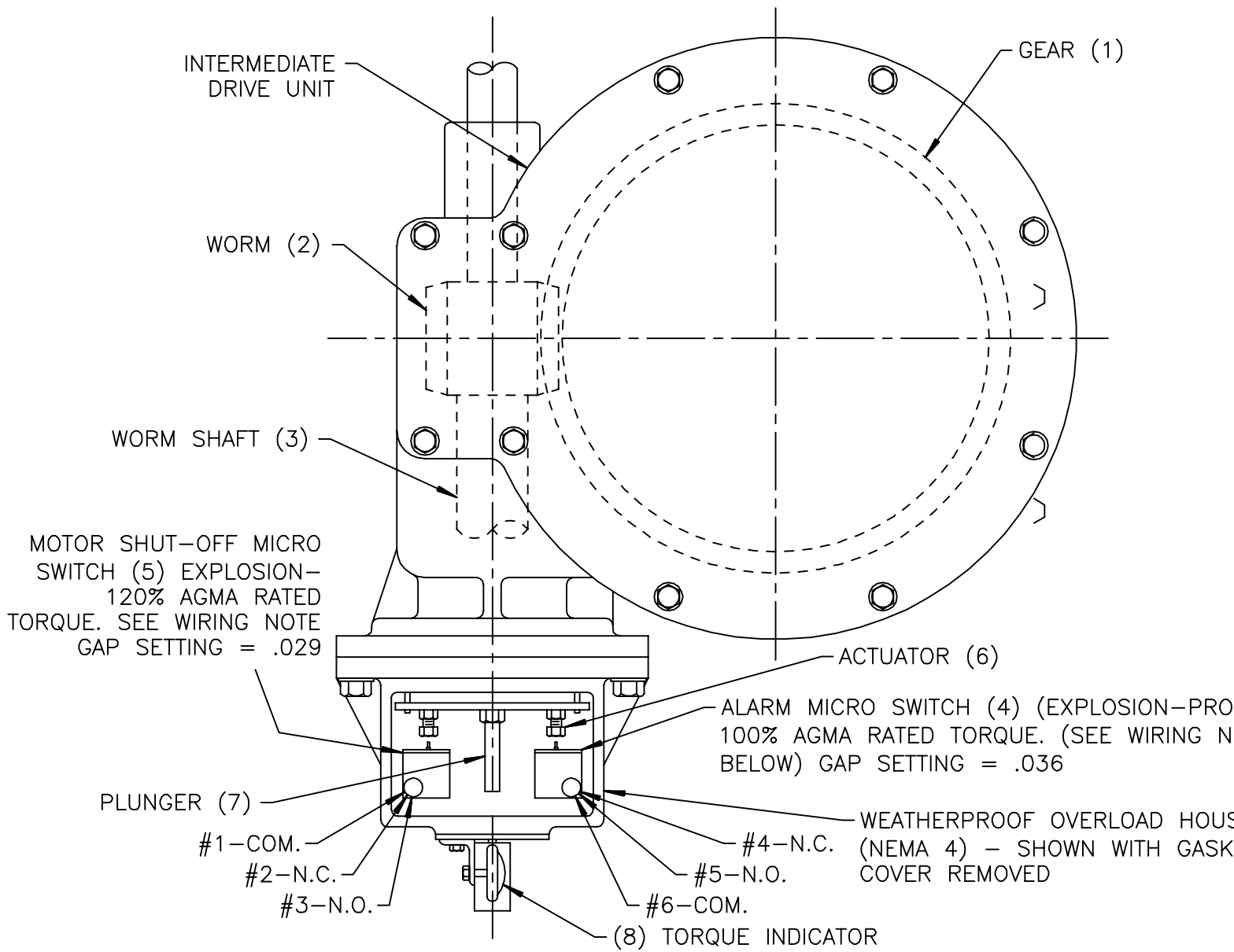
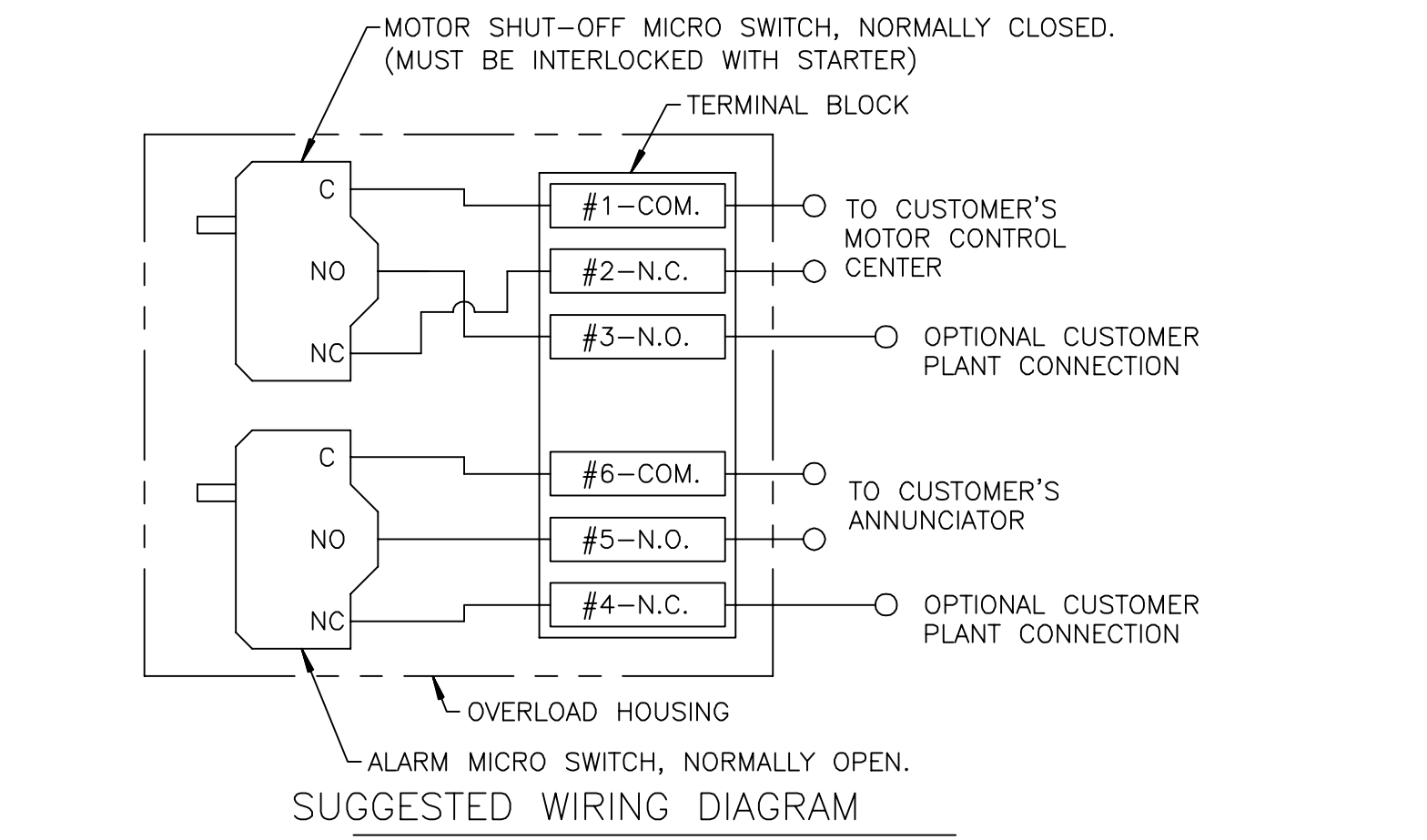
SPECIFICATIONS FOR H40A-HT TOW-BRO CLARIFIER

DRIVE MECHANISM	
MOTOR	
BALDOR 56C FRAME, 3/4 HORSEPOWER, 1800 RPM, XPFC 460 VOLT, 3 PHASE, 60 HERTZ, NEMA DESIGN B, CLASS "F" INSULATION, 50 DEG C AMBIENT TEMPERATURE, 1.15 SERVICE FACTOR, BALL BEARING TYPE MOTOR EXPLOSION PROOF CL.1. DIV.2	
PRIMARY REDUCTION	
EURODRIVE PARALLEL HELICAL REDUCER, R57AM 56 FRAME SIZE, 147.92:1 RATIO, 12.0 OUTPUT RPM, 1.25 MIN SERVICE FACTOR. CASE IS CAST IRON MOUNTED ON AN ADJUSTABLE STEEL BASE FOR CHAIN TENSION ADJUSTMENT.	
SECONDARY REDUCTION	
SPROCKETS: FABRICATED STEEL	
CHAIN: #80L "REDI-LUBE" STEEL ROLLER, SELF LUBRICATING	
GUARD: OSHA STYLE, COMPLETELY ENCLOSED, MOLDED POLYETHYLENE WITH ALUMINUM BACKPLATE	
INTERMEDIATE REDUCTION	
HOUSING: GREY IRON, CLASS 40B, ASTM A48	
SHAFTING: H.R. STEEL, AISI 4142 HEAT TREATED	
WORM: AISI 8620 HARDENED TEETH	
WORM GEAR: CENTRIFUGALLY CAST BRONZE ASTM B148-954	
BEARINGS: ANTI-FRICTION TYPE	
LUBRICATION: OIL BATH AND GREASE WITH OIL SEALS ON SHAFTING, HOUSING IS PROVIDED WITH FILL/DRAIN PIPES AND OIL LEVEL SIGHT GLASS.	
FINAL REDUCTION	
HOUSING: GREY IRON, CLASS 40B, ASTM A48	
PINION: AISI 4142 H.R. HARDENED TEETH	
INTERNAL SPUR GEAR: DUCTILE IRON ASTM A536	
TURNABLE BEARING	
BALL RACE DIA: 42 INCHES	
BALL QTY & TYPE: (131) 1" DIA BALLS, AISI 52100 CHROME ALLOY STEEL PER ASTM A295, HARDENED TO 62-66 ROCKWELL "C"	
LINERS: C.F. AISI 4140H HARDENED TO 39-43 ROCKWELL "C"	
LUBRICATION: OIL BATH WITH FELT SEAL AND DUST SHIELD, CONDENSATE DRAIN WITH BALL VALVE, HOUSING IS PROVIDED WITH OIL FILL PIPE, OIL DRAIN PIPE WITH BALL VALVE AND OIL LEVEL SIGHT GLASS.	
THE TURNTABLE ASSEMBLY IS DESIGNED SUCH THAT THE SPLIT INTERNAL GEAR, BALLS AND STRIP LINERS MAY BE REMOVED WITHOUT REMOVING THE MECHANISM ACCESS BRIDGE.	
OVERLOAD DEVICE	
MICRO SWITCHES (SEE OVERLOAD SYSTEM AT RIGHT) PLUS SHEAR PIN.	
DESIGN STANDARDS	
INTERMEDIATE REDUCTION GEARING	
AGMA 6034-B92 (SUPERSEDES 6034-A87) SINGLE AND DOUBLE REDUCTION OF CYLINDRICAL WORM AND HELICAL REDUCERS.	
FINAL REDUCTION GEARING	
AGMA 2001-C95 (SUPERSEDES 2001-B88) RATING THE PITTING RESISTANCE AND BENDING STRENGTH OF SPUR AND HELICAL INVOLUTE GEAR TEETH.	
BEARINGS	
MINIMUM L-10 LIFE 200,000 HOURS	
FINAL OUTPUT SPEED: .03 RPM	

DRIVE MECHANISM TORQUE RATINGS	
RATED TORQUE PER AGMA STANDARD:	31300 FT LBS (1.25 SF)
ALARM TORQUE (100% AGMA):	31300 FT LBS
MOTOR SHUT OFF TORQUE (120% AGMA):	37560 FT LBS
SHEAR PIN TORQUE (140% AGMA):	43820 FT LBS
SHEAR PIN PART NO:	103-81624-16
SHEAR PIN VALUE:	1693 LBS
CENTER PIER (2570#)	
42" DIAMETER CYLINDRICAL STEEL, .25" THICK, DESIGNED TO SUPPORT THE DRIVE UNIT, COLLECTOR MECHANISM AND THE ACCESS BRIDGE.	
CENTER CAGE (1880#)	
ALL WELDED CONSTRUCTION, FURNISHED IN ONE SECTION, CONSISTING OF STRUCTURAL STEEL MEMBERS HAVING A MINIMUM THICKNESS OF 1/4".	
INFLUENT WELL (2304#)	
24'-6" DIAMETER x 6'-0" DEPTH, FABRICATED OF 3/16" THICK STEEL PLATE WITH BOLTED FIELD SPLICES. DESIGNED SUCH THAT THE FLOW THROUGH VELOCITY DOES NOT EXCEED 0.15 FPS AT MAXIMUM FLOW. WELL IS PROVIDED WITH (4) EQUALLY SPACED BAFFLED SCUM PORTS.	
CYLINDRICAL MANIFOLD (1803#)	
ALL WELDED CONSTRUCTION, FABRICATED FROM STEEL PLATE AND FITTED WITH TWO (2) SEALING RINGS. MANIFOLD TO INCLUDE A DEFLECTOR BLADE WITH A NEOPRENE WIPER TO DIRECT SLUDGE TO THE FIRST ORIFICE ON THE UNITUBE HEADER.	

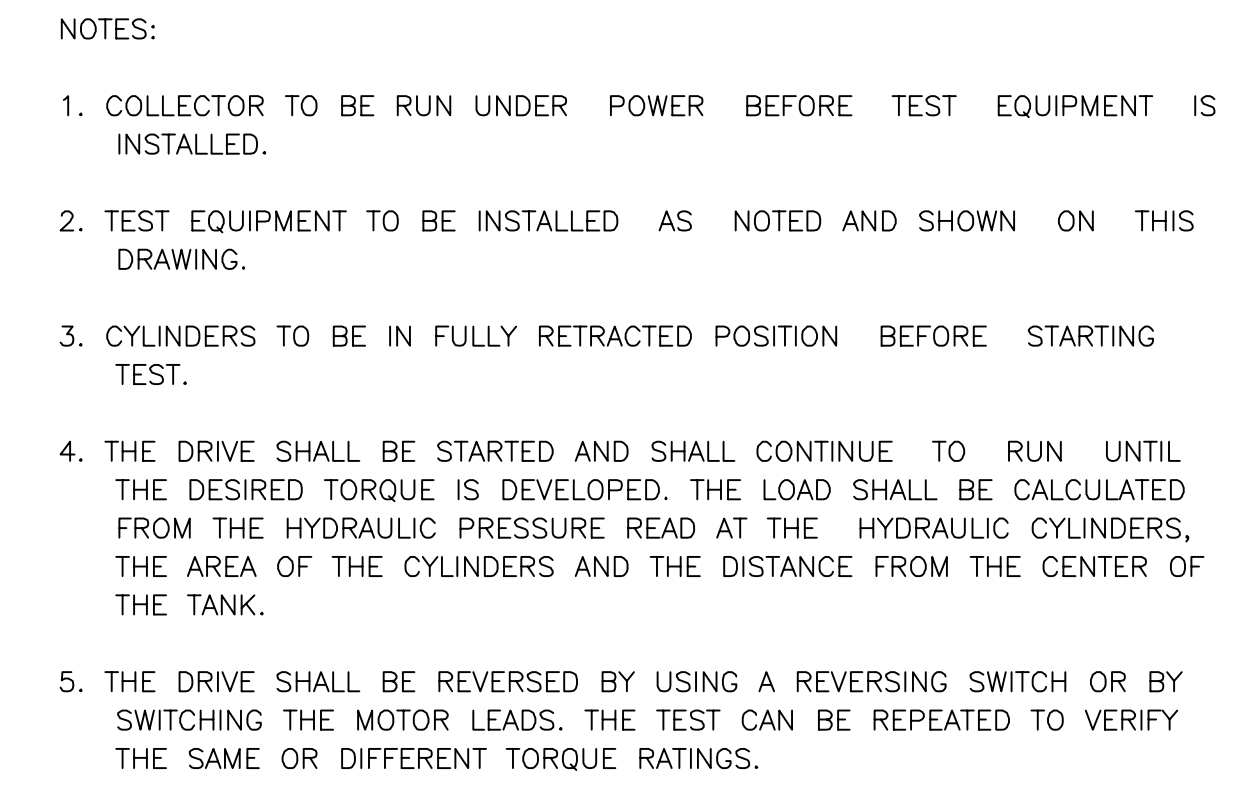
UNITUBE HEADER (3600#)	
A RECTANGULAR SHAPED FULL TAPERED SECTION, VARYING IN SIZE FROM A MAXIMUM NEAR THE TANK CENTER TO A MINIMUM AT THE OUTER END TO PROVIDE UNIFORM SLUDGE DRAW-OFF VELOCITIES. FABRICATED OF 1/4" THICK STEEL PLATE, HOT DIP GALVANIZED AFTER FABRICATION, INCLUDES DRAW-OFF ORIFICES EQUALLY SPACED ALONG THE LENGTH WITH THE SMALLER DIAMETER NEAR THE TANK CENTER AND THE LARGER AT THE OUTER END. TO INSURE HYDRAULIC BALANCE, THE HEADER IS TO INCLUDE A NEOPRENE WIPER ALONG THE ENTIRE BOTTOM LENGTH.	
HEADER SUPPORTS (120#)	
STEEL TIE BARS WITH GALVANIZED CLEVIS TO HOLD THE HEADER IN ALIGNMENT IN BOTH THE VERTICAL AND HORIZONTAL PLANES.	
TRUSS ARM (1661#)	
THE TRUSS ARM WILL BE SUPPORTED FROM THE CENTER CAGE AND MANIFOLD AND USED FOR SUPPORT OF THE ENTIRE SKIMMING MECHANISM. THE TRUSS ARM WILL BE OF ALL WELDED CONSTRUCTION CONSISTING OF STRUCTURAL STEEL MEMBERS HAVING A MINIMUM THICKNESS OF 1/4".	
FEDWA BAFFLES	
SEE GENERAL ARRANGEMENT-44792-106	
ACCESS BRIDGE (4682#)	
A PONY TRUSS STYLE BRIDGE, DIAGONALLY BRACED TO INSURE LATERAL STABILITY. ALL WELDED CONSTRUCTION PROVIDES CONVENIENT ACCESS TO THE DRIVE MECHANISM. WALKWAY MATERIAL WILL BE OHIO 19-SG-4 OR IKG BS 6063-T6 ALUMINUM PRESSURE-LOCKED GRATING WITH 1-1/4" BEARING BARS SPACED ON 1-3/16" CENTERS AND CROSSBARS SPACED ON 4" CENTERS. A CENTER PLATFORM WITH A WALKING SURFACE OF 7'-6" WIDE x 10'-0" LONG PROVIDES A MINIMUM CLEARANCE OF 2'-0" AROUND ALL COMPONENTS OF THE DRIVE MECHANISM.	
HANDRAIL (130#)	
STRUCTURAL MEMBERS OF PONY TRUSS BRIDGE ACT AS HANDRAIL AND TOE PLATE. HANDRAILING WILL MEET ALL OSHA REQUIREMENTS AND WILL CONSIST OF 1-1/2" SCHEDULE 40 6063-T6 (OR EQUAL) ALUMINUM PIPE OF THE 2 SCHEDULE 80 6061-T6 ALUMINUM. RAIL DESIGN WITH WELDED CONNECTORS HAVING STAINLESS STEEL FASTENERS. HANDRAILING SHALL HAVE CLEAR SATIN ANODIZED FINISH. MAX POST SPACING SHALL NOT EXCEED 5'-0".	
THE HANDRAIL WILL EXTEND AROUND DRIVE PLATFORM. HANDRAILING TOE PLATE WILL BE 4" HIGH EXTRUDED ALUMINUM CHANNEL.	
SURFACE SKIMMER ASSEMBLY (182#)	
HINGED TO INSURE CONTINUAL CONTACT AND PROPER ALIGNMENT WITH SCUM BAFFLE AND BEACH PLATE. OVERALL LENGTH OF SKIMMER IS 6'-0". A "FULL LENGTH" SCUM BLADE WILL BE PROVIDED, EXTENDING FROM THE INFLUENT WELL TO THE PERIPHERAL SCUM BAFFLE. SCUM BLADE AND SKIMMER ASSEMBLY ARE SUPPORTED BY FABRICATED STRUCTURAL STEEL A-FRAMES SUPPORTED BY THE TRUSS ARM.	
ALL WELDED CONSTRUCTION ADEQUATELY SUPPORTED FROM THE TANK WALL.	
TROUGH LENGTH: 8'-9" MEASURED ALONG SCUM BAFFLE (628#)	
TROUGH WIDTH: 6'-0"	
PIPE SIZE: 6"	
PIPE CONNECTOR: Field Weld Flange	
THE SCUM TROUGH IS FURNISHED WITH A 1/4" x 12" x 4' LONG BAFFLE EXTENSION, INCLUDING A SUBMERGED SHELF, SUPPORTED FROM THE SCUM TROUGH AND THE TANK WALL.	
THE SCUM TROUGH WILL BE SUPPLIED WITH A MECHANICAL OPERATING FLUSHING VALVE INCLUDING A LEVER ARM, HINGED FLAPPER VALVE WITH SEAL, AND COUNTERWEIGHTS TO SERVE AS A WATER FLUSHING DEVICE ACTIVATED BY THE SKIMMER FOR EACH REVOLUTION.	
SCUM BAFFLE	
NOT BY Siemens Industry, Inc.	
WEIR PLATES	
NOT BY Siemens Industry, Inc.	
NOTE	
SCUM BAFFLE TO BE CONCENTRIC WITH CENTER OF TANK. ALL JOINTS MUST BE BUTT CLOSELY AND INSIDE OF BAFFLE MUST NOT HAVE ANY PROJECTIONS SUCH AS WELDS, BOLT HEADS, ETC.	
FEDWA BAFFLES	
FEDWA INLET ARRANGEMENT CONSISTS OF SUCCESSIVE CONCENTRIC BAFFLES WITH HORIZONTAL BOTTOM PLATES TO BOTH DISSIPATE AND PROMOTE PARTICLE CONTACT AND FLOCC GROWTH BASED ON ESTABLISHED MOTIONLESS MIXER AND TAPERED FLOCCULATION THEORY. WITH THIS DESIGN, INLET FLOW AREA GRADUALLY INCREASES, REDUCING VELOCITY AND SHEAR RATES AS FLOCC GROWS IN SIZE. ALL MATERIAL IS 3/16" THICK (A36 STEEL).	
EQUIPMENT FASTENERS	
ALL FASTENERS FOR EQUIPMENT ASSEMBLY WILL BE 316 SS, EXCEPT FOR THE BOLTS USED TO ATTACH THE TRUSS ARMS TO THE CAGE AND HEADER TO THE CAGE. THESE BOLTS WILL BE HOT-DIP GALVANIZED A325.	

ANCHOR BOLTS	
ALL ANCHOR BOLTS WILL BE HEADED TYPE (CENTER PIER) OR ADHESIVE TYPE (ALL OTHERS). MATERIAL WILL BE 316 STAINLESS STEEL. ALL ANCHOR BOLTS WILL BE OF AMPLE SIZE AND STRENGTH FOR THE PURPOSE INTENDED. ALL ANCHOR BOLTS WILL BE SET BY THE GENERAL CONTRACTOR IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS.	
SPECIAL SURFACE PREPARATIONS	
1. SHARP CORNERS OF CUT OR SHEARED EDGES WILL BE DULLED WITH AT LEAST ONE PASS OF A POWER GRINDER TO CREATE A SMOOTH EDGE.	
2. IN ADDITION TO WELDS INDECATED ON DETAIL DRAWINS, ALL JOINTS WILL BE SEALED WATER TIGHT WITH 1/8" CONTINOUS WELD	
3. ALL SHARP WELDS AND BURRS WILL BE GROUND AND FLUX AND SPATTER REMOVED.	
PAINT NOTE	
ALL SHAFTING AND EXPOSED MACHINED SURFACES TO RECEIVE (1) COAT OF A CORROSION INHIBITOR. ALL NON-FERROUS MATERIAL AND GALVANIZED SURFACES WILL REMAIN UNPAINTED. PURCHASED GEARMOTORS/REDUCERS AND CONTROLS WILL REMAIN THE MANUFACTURERS STANDARD PAINT SYSTEM. CIRCULAR DRIVE UNIT WILL BE SHOP FINISHED WITH Siemens Water Technologies STANDARD SHERWIN-WILLIAMS DURA-PLATE 235 BLUE EPOXY.	
ALL FERROUS STRUCTURAL STEEL SHAPES, PLATES AND CASTINGS WILL BE PREPARED AS FOLLOWS:	
ALL NON-SUBMERGED SURFACES TO BE BLAST CLEANED PER SSPC-SP10 THEN RECEIVE AT LEAST ONE SHOP PRIME COAT OF TNEMEC SERIES 90G -1K97 COLOR GRAY. TO PRODUCE A MINIMUM DRY FILM THICKNESS OF 2.5 TO 3.5 MILS.	
ALL SUBMERGED SURFACES TO BE BLAST CLEANED PER SSPC-SP10 THEN RECEIVE AT LEAST ONE SHOP PRIME COAT OF TNEMEC SERIES 1 OMNITHANE COLOR GRAY. TO PRODUCE A MINIMUM DRY FILM THICKNESS OF 2.5 TO 3.0 MILS.	
ALL TOUCH-UP AND ANY ADDITIONAL GALVANIZED SURFACE REPAIR TO BE FURNISHED BY CUSTOMER.	
CUSTOMER'S NOTE	
UNLESS OTHERWISE SPECIFIED, Siemens Industry, Inc. WILL NOT FURNISH ANY OF THE FOLLOWING:	
ELECTRICAL, HYDRAULIC OR PNEUMATIC CONTROLS, WIRING OF MOTORS OR CONTROLS, CONTROL PANELS OR SUPPORTS, PIPING, VALVES, WALL SLEEVES, GATES OR DRAINS, GRATING, STAIRWAYS, LADDERS, CONCRETE, GROUT, MASTIC OR SEALING COMPOUNDS, GUIDES, WEIRS OR SCUM BAFFLES, LUBRICANTS FOR DRIVES OR BEARINGS, GREASE PIPING OR GREASE GUN, SETTING OF ANCHOR BOLTS (WHETHER FURNISHED BY Siemens Industry, Inc. OR OTHERS), DETAIL SHOP FABRICATION DRAWINGS, TOOLS OR SPARE PARTS MODIFICATIONS TO EXISTING EQUIPMENT OR STRUCTURES.	
CONCRETE DESIGN	
Siemens Industry, Inc. IS NOT RESPONSIBLE FOR CONCRETE DESIGN. REINFORCING STEEL FOR TANKS TO BE FURNISHED BY OTHERS WHO WILL ALSO SIZE THE WALLS AND FOOTINGS TO SUIT LOCAL GROUND CONDITIONS. FOR DIMENSIONS NOT SHOWN, REFER TO ENGINEER'S DRAWINGS.	
ERECTION NOTE	
CORRECTIONS OF MINOR MISFITS AND A REASONABLE AMOUNT OF CUTTING AND REAMING ARE CONSIDERED A PART OF ERECTION. ANY ERROR WHICH PREVENTS ASSEMBLY BY MODERATE USE OF DRIFT PINS, CUTTING, OR WELDING, IS TO BE REPORTED AND APPROVAL OF CORRECTION OR CHANGE IS TO BE RECEIVED IN WRITING BEFORE PROCEEDING. FAILURE TO COMPLY WILL RELIEVE Siemens Industry, Inc. OF ALL OPERATIONAL AND MONETARY RESPONSIBILITY.	
SUPERVISION AND/OR INSPECTION OF ERECTION:	
SERVICES OF A FACTORY REPRESENTATIVE WILL BE FURNISHED IN ACCORDANCE WITH THE TERMS OF OUR CONTRACT.	
DESIGN DATA	
BRIDGE LIVE LOAD:	
BRIDGE DEFLECTION:	
STRUCTURAL SHAPES SHALL CONFORM TO ASTM A36. WELDING SHALL CONFORM TO AWS-D1.1. ALL SUBMERGED STEEL PLATES AND SHAPES TO HAVE A MINIMUM THICKNESS OF 1/4" UNLESS OTHERWISE SPECIFIED.	
SAFETY HAZARD WARNING LABELS	
LABELS ARE AFFIXED ON "Siemens Industry" EQUIPMENT WHEN A VISUAL WARNING IS APPROPRIATE. THE EQUIPMENT OWNER IS RESPONSIBLE FOR KEEPING THESE LABELS VISIBLE AND IN GOOD CONDITION. REPLACEMENT LABELS ARE AVAILABLE FROM THE "Siemens Water Technologies PARTS DEPARTMENT".	

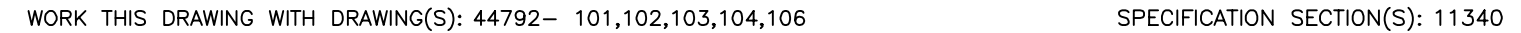
SEQUENCE OF OPERATION	
AS TORQUE IS APPLIED TO THE GEAR (1), THE WORM (2) & WORM SHAFT (3) ARE FORCED TOWARD THE MICRO SWITCHES (4 & 5). AS THE WORM SHAFT (3) MOVES, THE GAP CLOSSES BETWEEN THE MICRO SWITCH ACTUATOR (6) AND THE MICRO SWITCHES (4 & 5). WHEN THE TORQUE LOAD REACHES 100% OF THE AGMA RATED TORQUE, THE MICRO SWITCH (4) CONTROLLING THE ALARM SYSTEM CLOSSES AND THE ALARM CIRCUIT IS ACTIVATED, THUS SOUNDING AN ALARM AND/OR HORN (NOT BY Siemens Industry Inc). WHEN THE TORQUE LOAD REACHES 120% OF THE AGMA RATED TORQUE, THE MICRO SWITCH (5) INTERLOCKED WITH THE STARTER OPENS AND DE-ENERGIZES THE MAGNETIC STARTER COIL, WHICH IN TURN, OPENS A HOLDING CIRCUIT INTERLOCK, OPENING THE CIRCUIT AND STOPPING THE MOTOR. THE MOVEMENT OF THE WORM SHAFT (3) ALSO PUSHES AGAINST THE PLUNGER (7) IN THE TORQUE INDICATOR (8) CAUSING MOVEMENT OF THE POINTER. TORQUE OVERLOAD SYSTEM IS OPERATIONAL ONLY WHEN EQUIPMENT ROTATES AS SHOWN ON THE GENERAL ARRANGEMENT DRAWING.	
NOTES	
MICRO SWITCH RATINGS: 15 AMPS @ 125 VOLTS AND 480 VOLTS, ALL "AC" CURRENT.	
	
MOTOR SHUT-OFF MICRO SWITCH (5) EXPLOSION-120% AGMA RATED TORQUE. SEE WIRING NOTE BELOW) GAP SETTING = .029	
ALARM MICRO SWITCH (4) (EXPLOSION-PROOF) 100% AGMA RATED TORQUE. (SEE WIRING NOTE BELOW) GAP SETTING = .036	
WEATHERPROOF OVERLOAD HOUSING (NEMA 4) - SHOWN WITH GASKETED COVER REMOVED	
MICROSWITCH WIRING NOTE	
MICRO SWITCHES PROVIDED WITH DRIVE ARE EXPLOSION PROOF. THE WIRES ARE NUMBERED AS INDICATED AND BROUGHT DIRECTLY FROM THE SWITCH TERMINALS THROUGH THE 1/2" PIPE NIPPLES WHICH PROJECT THROUGH THE BOTTOM OF THE HOUSING. THE ELECTRICAL CONTRACTOR MUST USE EXPLOSION PROOF FLEXIBLE COUPLINGS BETWEEN THE PIPE NIPPLES AND HIS RIGID CONDUIT AND/OR JUNCTION BOX.	
	

WORK THIS DRAWING WITH DRAWINGS 44792-101, 102,103,105,106 SPECIFICATION SECTION 11340

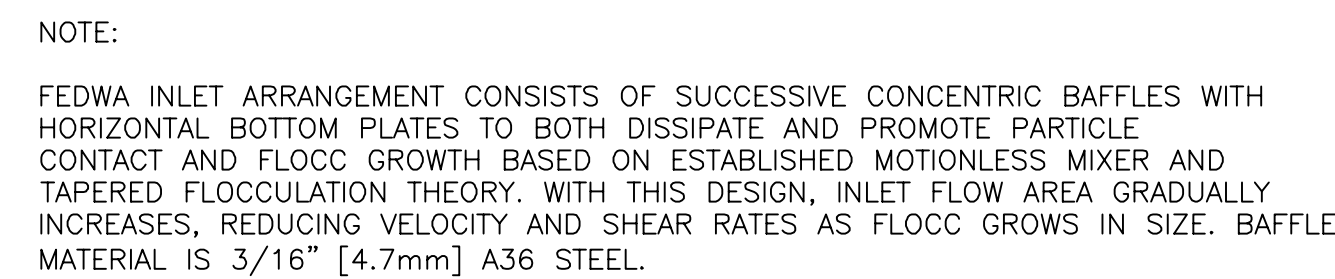
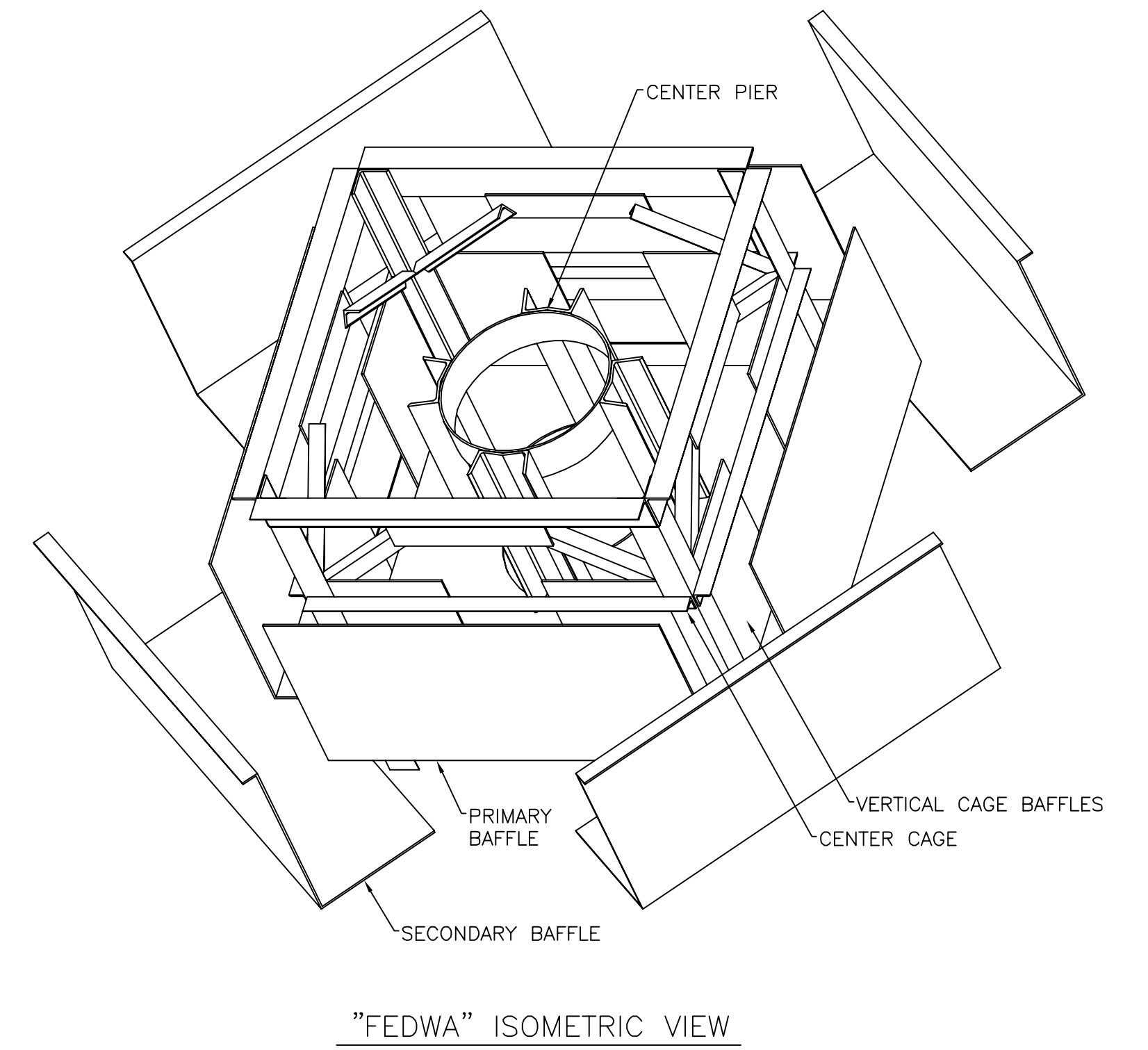
DIMENSIONS IN INCHES UNLESS SPECIFIED		TOLERANCES UNLESS OTHERWISE SPECIFIED		TWO (2) PLACE DEC. ±.06		THREE (3) PLACE DEC. ±.005		ANGULAR ±.50"		STRUCTURAL DIMENSIONS ± 1/16		MACHINED SURFACES .250/		RELEASE FOR FABRICATION		UPDATED PER SUBMITTAL REVIEW COMENTS		DATE		DWN		CHKD		APVD		ECN		COMPANY CONFIDENTIAL		THIS DOCUMENT AND ALL INFORMATION CONTAINED HEREIN ARE THE PROPERTY OF SIEMENS AND/OR ITS AFFILIATES. THE DESIGN CONCEPTS AND INFORMATION CONTAINED HEREIN ARE PROPRIETARY TO SIEMENS AND ARE SUBMITTED IN CONFIDENCE. THEY ARE NOT TRANSFERABLE AND MUST BE USED ONLY FOR THE PURPOSE FOR WHICH THE DOCUMENT IS EXPRESSLY LOANED. THEY MUST NOT BE REPRODUCED, LOANED OR USED IN ANY OTHER MANNER WITHOUT THE EXPRESS WRITTEN CONSENT OF SIEMENS. IN NO EVENT SHALL THEY BE USED IN ANY MANNER DETRIMENTAL TO THE INTEREST OF SIEMENS. ALL PATENT RIGHTS ARE RESERVED. UPON THE DEMAND OF SIEMENS, THIS DOCUMENT, ALONG WITH ALL COPIES AND EXTRACTS, AND ALL RELATED NOTES AND ANALYSES, MUST BE RETURNED TO SIEMENS OR DESTROYED, AS INSTRUCTED BY SIEMENS. ACCEPTANCE OF THE DELIVERY OF THIS DOCUMENT CONSTITUTES AGREEMENT TO THESE TERMS AND CONDITIONS.		DESIGNER MV		DATE 10-8-12		CHECKER MV		DATE 10-8-12		ENGINEER		DATE		MANAGER		DATE		MADE FROM		SCALE: 3/4"=1'-0"		PROJECT 2033/000140		CODE 4003		DRAWING 44792-104		SHEET 1 OF 1		REV 0	
STD: 1-0200-24X36D1		INTL REF:		03/21/2013 - 10:20 AM		BAR = 1" AT PLOT SCALE		REV		DESCRIPTION		DATE		DWN		CHKD		APVD		ECN		COMPANY CONFIDENTIAL		THIS DOCUMENT AND ALL INFORMATION CONTAINED HEREIN ARE THE PROPERTY OF SIEMENS AND/OR ITS AFFILIATES. THE DESIGN CONCEPTS AND INFORMATION CONTAINED HEREIN ARE PROPRIETARY TO SIEMENS AND ARE SUBMITTED IN CONFIDENCE. THEY ARE NOT TRANSFERABLE AND MUST BE USED ONLY FOR THE PURPOSE FOR WHICH THE DOCUMENT IS EXPRESSLY LOANED. THEY MUST NOT BE REPRODUCED, LOANED OR USED IN ANY OTHER MANNER WITHOUT THE EXPRESS WRITTEN CONSENT OF SIEMENS. IN NO EVENT SHALL THEY BE USED IN ANY MANNER DETRIMENTAL TO THE INTEREST OF SIEMENS. ALL PATENT RIGHTS ARE RESERVED. UPON THE DEMAND OF SIEMENS, THIS DOCUMENT, ALONG WITH ALL COPIES AND EXTRACTS, AND ALL RELATED NOTES AND ANALYSES, MUST BE RETURNED TO SIEMENS OR DESTROYED, AS INSTRUCTED BY SIEMENS. ACCEPTANCE OF THE DELIVERY OF THIS DOCUMENT CONSTITUTES AGREEMENT TO THESE TERMS AND CONDITIONS.		DESIGNER MV		DATE 10-8-12		CHECKER MV		DATE 10-8-12		ENGINEER		DATE		MANAGER		DATE		MADE FROM		SCALE: 3/4"=1'-0"		PROJECT 2033/000140		CODE 4003		DRAWING 44792-104		SHEET 1 OF 1		REV 0							



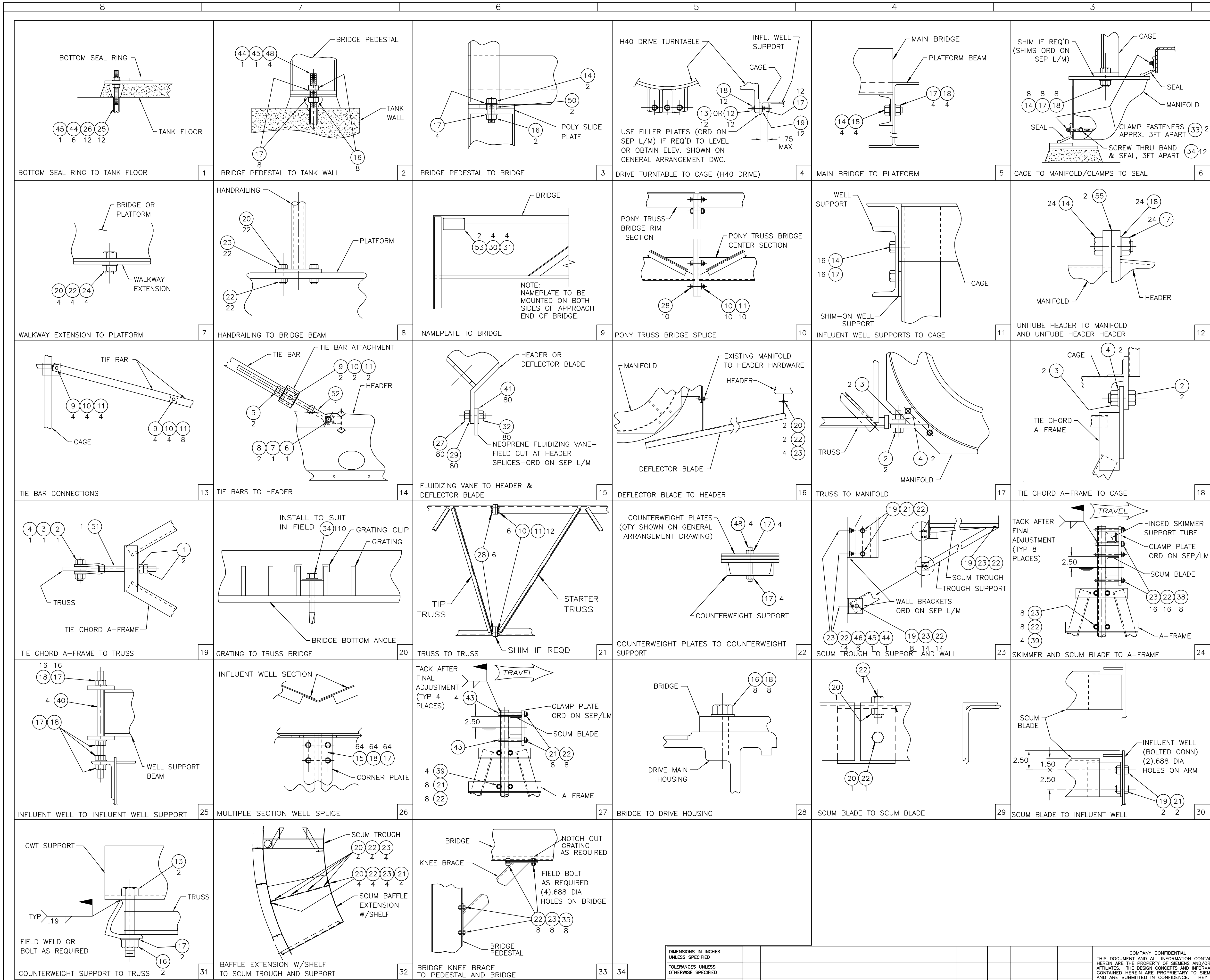
NOTES: GAUGE PRESSURE IS BASED ON EFFECTIVE PISTON AREA OF
1.46 SQ INCHES. (1-1/2" DIA BORE - 5/8" DIA ROD)



STD: 1-0200-24X36D1	INTL REF:	03/21/2013 - 10:20 AM	<div style="border: 1px solid black; width: 40px; height: 15px; display: inline-block;"></div> BAR = 1" AT PLOT SCALE	REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN	AGREEMENT TO THESE TERMS AND CONDITIONS.	SCALE: 3/4"=1'-0"	2033/000140	4003	44792-105	1 OF 1	0
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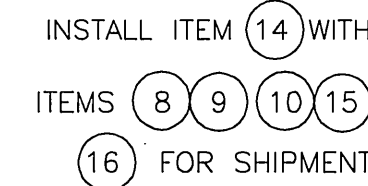
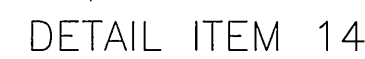


WORK THIS DRAWING WITH DRAWING(S): 44792- 101,102,103,104,105,106		SPECIFICATION SECTION(S): 11340				
COMPANY CONFIDENTIAL		DESIGNER	DATE	TITLE: GENERAL ARRANGEMENT - FEDWA ARRANGEMENT		
THIS DOCUMENT AND ALL INFORMATION CONTAINED HEREIN ARE THE PROPERTY OF SEMENS AND/OR ITS AFFILIATES. THE DESIGN CONCEPTS AND INFORMATION CONTAINED HEREIN ARE NOT TO BE REPRODUCED, COPIED, TRANSMITTED, OR USED IN ANY MANNER WITHOUT THE WRITTEN PERMISSION OF SEMENS. IN NO EVENT SHALL THEY BE USED IN ANY MANNER DESTROYED TO THE DETERIMENT OF SEMENS. ALL PATENT RIGHTS ARE RESERVED. UPON THE DEMAND OF SEMENS, THIS DOCUMENT, ALONG WITH ALL COPIES AND EXTRACTS, AND ALL RELATED NOTES AND ANALYSES, MUST BE RETURNED TO SEMENS OR DESTROYED AS INSTRUCTED BY SEMENS. ACCEPTANCE OF THE DELIVERY OF THIS DOCUMENT TO SEMENS OR DESTROYED AS INSTRUCTED BY SEMENS. CONDITIONS	CHECK	10-8-12	(3) 120'-0" DIA H40AHT TOW BRO CLARIFIERS CUST: MAX FOOTE CONSTRUCTION CO. LOC: BOSSIER CITY, LA ENG: MANCHAC CONSULTING GROUP, INC.			
	ENGINEER	DATE				
	MANAGER	DATE				
	MADE FROM:					
SCALE: 3/4"=1'-0"		PROJECT	CODE	DRAWING	SHEET	REV
		2033/000140	4003	44792-106	1 OF 1	0

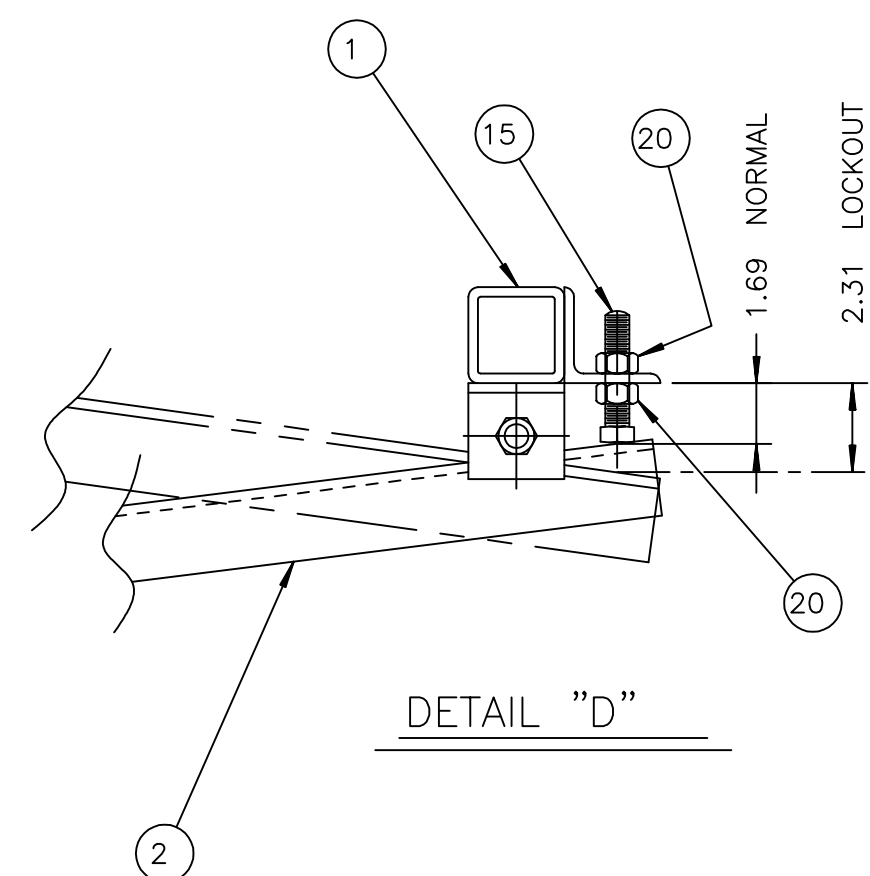
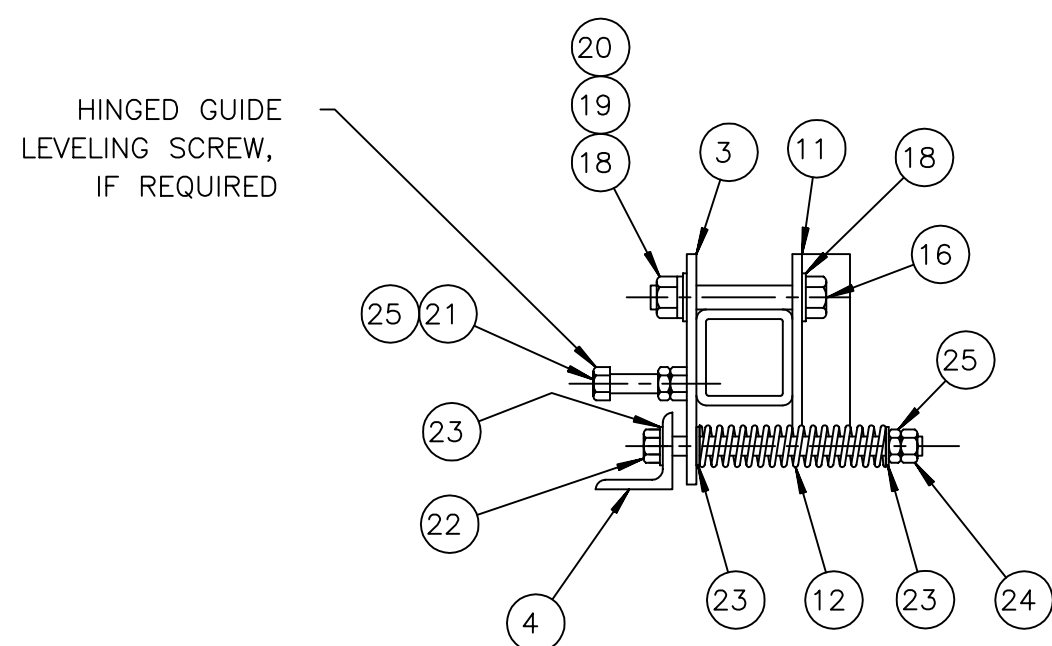
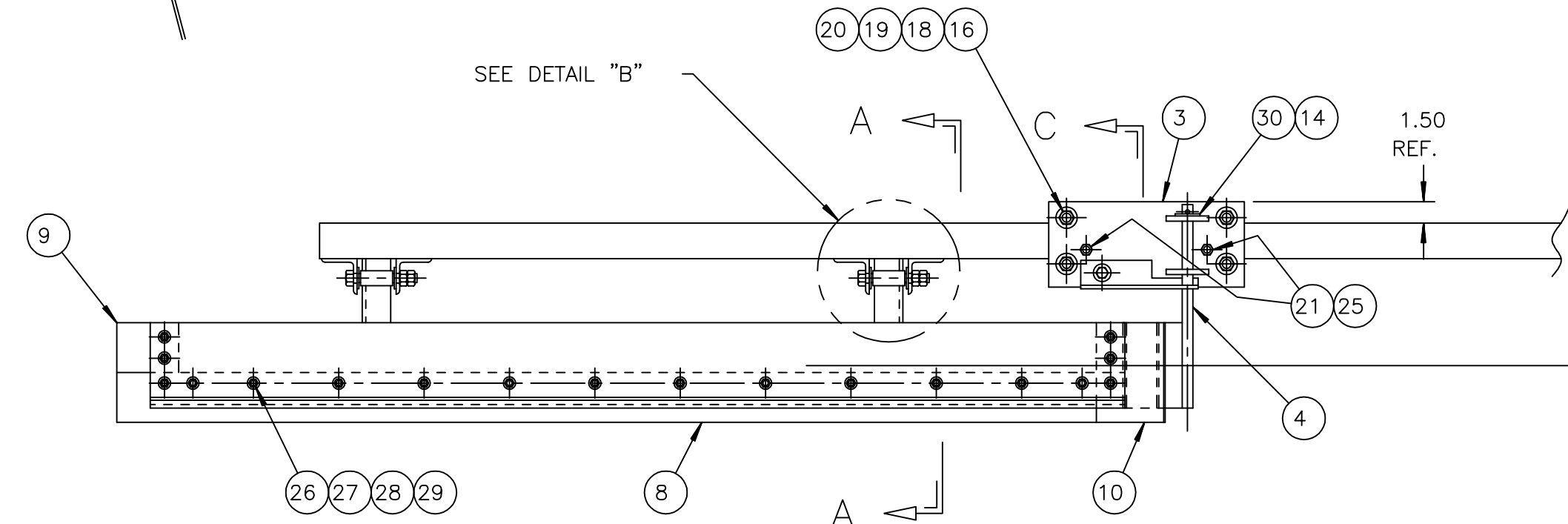


2		1			
LIST OF COMPONENTS				ESTIMATED FINISHED WEIGHT	DRAWING NUMBER
TITLE				ALL LENGTHS ARE FINAL UNLESS OTHERWISE SPECIFIED	PROJECT NUMBER
FIELD CONNECTIONS AND MATERIAL LIST					2033/000140
ADVANCE ORDER	REF. SYMBOL	QUANTITY	PART NUMBER	DESCRIPTION	
MATERIAL FOR ONE W3T261181					
	1	2	841-20695	1-3/4 HEX NUT	316SS
	2	5	841-11430	1-1/2 x 4.50 HHCS	HDG A325
	3	5	841-20649	1-1/2 HEX NUT	HDG A325
	4	5	841-22308	1-1/2 HARDENED WASHER	HDG A325
	5	2	841-20621	1 1/4 HEX NUT	316SS
	6	1	841-11313	1 x 3.50 HHCS	HDG A325
	7	1	841-20516	1 HEX NUT	HDG A325
	8	2	841-22211	1 HARDENED WASHER	HDG A325
	9	12	841-15090	3/4 x 2.00 HHCS	HDG A325
	10	42	841-20375	3/4 HEX NUT	HDG A325
	11	38	841-22122	3/4 HARDENED WASHER	HDG A325
	12	14	841-11041	3/4 x 4.00 HHCS	316SS
	13	16	841-10901	3/4 x 3.00 HHCS	316SS
	14	60	841-10825	3/4 x 2.50 HHCS	316SS
	15	70	841-10701	3/4 x 1.75 HHCS	316SS
	16	26	841-10561	3/4 x 1.25 HHCS	316SS
	17	160	841-20385	3/4 HEX NUT	316SS
	18	150	841-22095	3/4 PLAIN WASHER	316SS
	19	25	841-22701	3/4 LOCK WASHER	316SS
	20	50	841-09861	5/8 x 1.75 HHCS	316SS
	21	25	841-13841	5/8 x 1.50 FHMS	316SS
	22	120	841-20305	5/8 HEX NUT	316SS
	23	90	841-21991	5/8 PLAIN WASHER	316SS
	24	6	841-22610	5/8 LOCK WASHER	316SS
	25	14	841-20225	1/2 HEX NUT	316SS
	26	14	841-21935	1/2 PLAIN WASHER	316SS
	27	87	841-08725	3/8 x 1.25 HHCS	316SS
	28	18	841-10921	3/4 x 3.25 HHCS	HDG A325
	29	87	841-21859	3/8 PLAIN WASHER	316SS
	30	8	841-12640	#10-32 x 0.50 RHMS	SS
	31	8	841-20006	#10-32 HEX NUT	SS
	32	87	841-20866	3/8 LOCK NUT W/NYLON RING	316SS
	33	2	303-1380-1	CLAMP KIT	SS
	34	125	841-17041	1/4" x 2.00 HEX WASH HD SELF DR SC	SS
	35	10	841-09861	5/8 x 1.75 HHCS	316SS
	36				
	37				
	38	12	103-51563-2	5/8 DIA U-BOLT	304SS
	39	8	103-50318-40	5/8 DIA U-BOLT	316SS
	40	4	941-06131-24.00	3/4 x 24.00 LG. THREADED ROD	316SS
	41	87	841-21885	3/8 FENDER WASHER	316SS
	42				
	43	8	941-06113-7.75	1/2 x 7.75 LG. THREADED ROD	316SS
	44	3	43660-109-43	HILTI-HIT HY 150 MAX ADHESIVE PACK	283548
	45	1	841-30414	ADHESIVE INJECTION DISPENSER	
				HILTI MD2000 FOR HIT HY 150	00229154
	46	6	941-06123-6.50	5/8 x 6.50 LG. THREADED ROD	316SS
	47				
	48	8	941-06131-12.12	3/4 x 12.12 LG. THREADED ROD	316SS
	49				
	50	4	103-81446-3	ANCHOR SPACER	
	51	1	603-31090-83	CLEVIS NUT ASSEMBLY	316SS
	52	1	603-31090-85	CLEVIS NUT ASSEMBLY	316SS
	53	2	303-80448-6	NAMEPLATE "TOW-BRO CLARIFIER"	
	54				
	55	2	841-30400	SILICONE CAULK, 12 OZ TUBE	
PURSHASING AND VENDER NOTES					
1. EACH QUANTITY OF LIKE ITEMS TO BE BOXED AND TAGGED WITH THE FOLLOWING INFORMATION:					
• Siemens Industry PART NUMBER					
• PART DESCRIPTION					
• VENDOR CROSS REFERENCE PART NUMBER					
• BOXED/BAGGED QUANTITY					
2. THE MK-100 ASSEMBLY IS FOR ONE TANK, AND SHOULD BE CONSOLIDATED AS A SINGLE BOX OR WRAPPED PALLET AND TAGGED WITH THE FOLLOWING INFORMATION:					
• Siemens Industry PURCHASE ORDER NUMBER					
• Siemens Industry DRAWING NUMBER					
• Siemens Industry CUSTOMER PURCHASE ORDER NUMBER AND OTHER SHIPPING NOTES AS LISTED ON OUR PURCHASE ORDER					
• A NOTE STATING "FOR ONE TANK"					
3. IF A SINGLE PALLET IS MADE FOR MULTIPLE ASSEMBLIES, EACH ASSEMBLY SHOULD BE BOXED OR WRAPPED SEPARATELY.					
DESIGNER	DATE	TITLE			
	1-25-13	FIELD CONNECTIONS & MATERIALS LIST FOR (3) 120' DIA TOW-BRO CLARIFIER			
CHECKER	DATE	H4O DRIVE (QTY FOR 1 TANK)			
	1-25-13	CLIENT			
ENGINEER	DATE				
MANAGER	DATE				
SCALE: NTS		PROJECT 2033/000140			
		CODE 4003		DRAWING 44792-108	
				SHEET 1 OF 1	
				REV 0	
		Water Industry Waukesha, WI 262-547-0141			

STD: 1-0200-24X36D1	INTL REF:
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AT PLOT SCALE	REV
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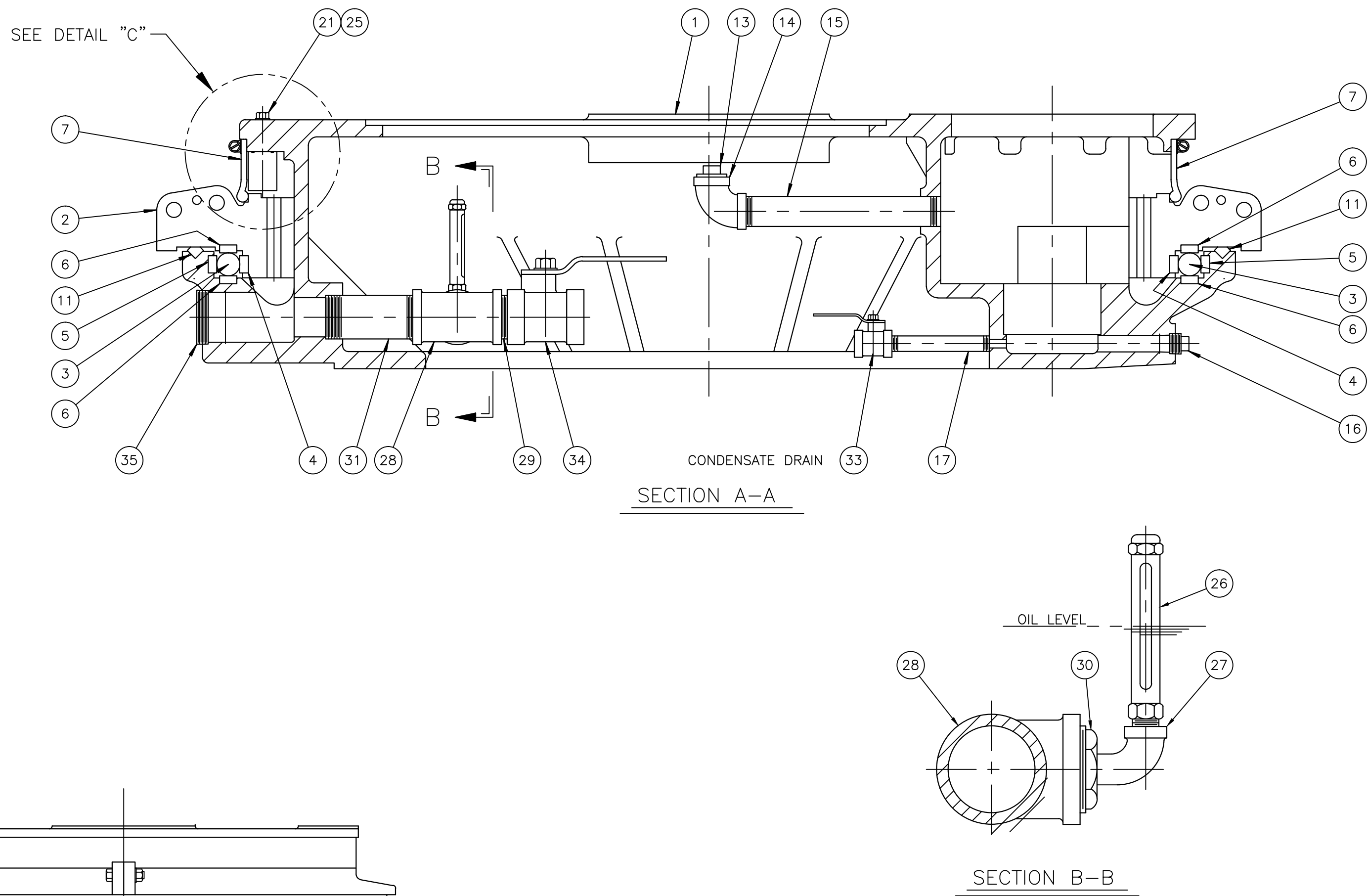


THE FOLLOWING ITEMS ARE LISTED FOR LOCATION REFERENCE ONLY.				
THESE ITEMS ARE INCLUDED IN ITEM 13 HARDWARE KIT.				
14	*	841-19215	1/4 x 1.50 COTTER PIN	SS
15	*	841-16382	5/8 x 3.00 SQ. HD. SETSCREW	304SS
16	*	841-10371	5/8 x 4.50 HHCS	316SS
17				
18	*	841-21991	5/8 CUT WASHER	316SS
19	*	841-22610	5/8 LOCK WASHER	316SS
20	*	841-20305	5/8 HEX NUT	316SS
21	*	841-09421	1/2 x 2.00 HHCS	316SS
22	*	841-09797	1/2 x 7.00 HHCS	316SS
23	*	841-21935	1/2 CUT WASHER	316SS
24	*	841-20225	1/2 HEX NUT	316SS
25	*	841-20985	1/2 JAM NUT	316SS
26	*	841-08725	3/8 x 1.25 HHCS	316SS
27	*	841-21858	3/8 CUT WASHER	316SS
28	*	841-22495	3/8 LOCK WASHER	316SS
29	*	841-20125	3/8 HEX NUT	316SS
30	*	841-22095	3/4 CUT WASHER	316SS

NOTES:

- FOR SCUM BAFFLE DIA LESS THAN 66'-0"
SEE DRAWING 603-81670.
- FOR WIPER REPLACEMENT SEE DRAWING
603-31075 KIT #3.

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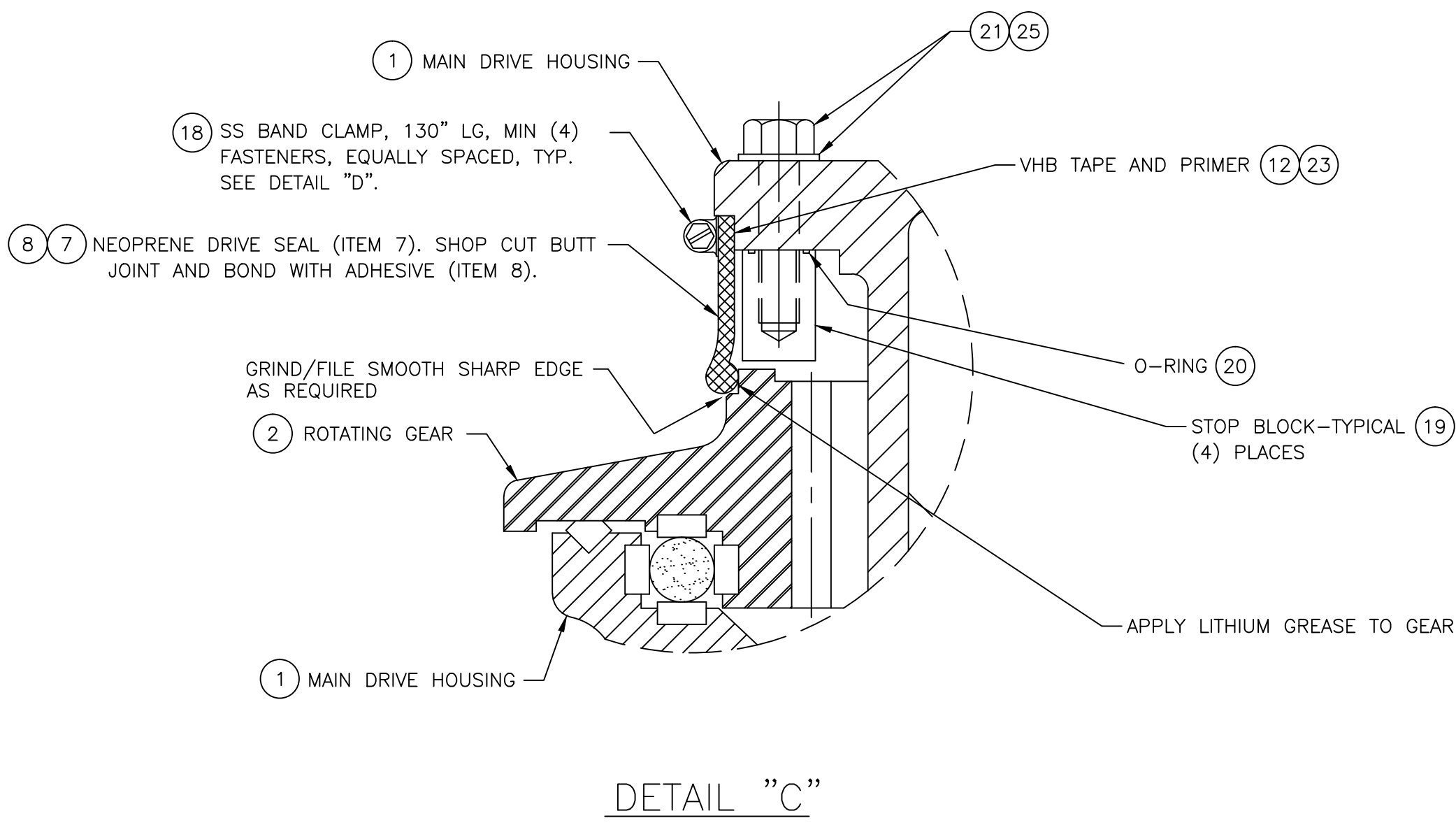
LIST OF COMPONENTS						
REF. SYMBOL	QUANTITY		PART NUMBER	DESCRIPTION		MATERIAL
MATERIAL FOR ONE ASSEMBLY 603-81656-80 (W3T22409)						EST. FIN. WGT: 1180#
1	1	W3T19373	403-70064-10	HOUSING-MAIN		
2	1	W3T19380	403-70065-81	GEAR-INTERNAL		
3	131		XCA 3834-1	CHROME STEEL BALL		
4	4	W3T18346	103-74-1	BEARING RING-INNER		
5	4	W3T18359	103-74-3	BEARING RING OUTER		
6	8	W3T18356	103-74-2	BEARING RING-UPPER & LOWER		
7	11.08'	W2T117226	303-60642-1	DUST SEAL		NEO
8	1	W2T1219	303-2404-1	ADHESIVE, CYANOACRYLATE (2 GRAM TUBE)		
9	1	W3T18251	103-51179-2	COVER		
10	1	W3T21132	503-41335-80	COVER		
11	12'-0"	W2T118212	841-26980	1/2" SQ x 12'-0" FELT STRIP		
12	11.08'	W2T116937	303-2401-1	3M TAPE, VHB 4941, 3/4" WIDE		
13	1	W2T122978	841-03020	PIPE PLUG, SQ HD, 1" NPT		GALV
14	1	W2T119679	841-01760	PIPE ELBOW, 90°, 1" NPT		GALV
15	1	W2T120015	841-05900	PIPE NIPPLE, 1" NPT x 9"		GALV
16	1	W2T313456	841-02960	PIPE PLUG, SQ HD, 1/2" NPT		GALV
17	1	W2T120479	841-05460	PIPE NIPPLE, 3/8" NPT x 5"		GALV
18	2	W2T118115	303-2113-1	STOP CLAMP		SS
19	4	W2T118950	103-51634-1	BAND BLOCK (FOR USE WITH O-RING)		
20	4	W2T12220	303-2405-1	O-RING, TYPE 2-019		
21	4	W2T313616	841-10040	5/8 x 2.25 HHCS		SS
22	2	W2T116938	303-2402-1	ALCOHOL SWAB		
23	1	W2T116936	303-2400-1	PRIMER, 3M #94, 0.66ml AMPULE		
24	A/R	W2T318050	303-2403-1	ELECTRICAL TAPE		
25	4	W2T122708	841-22620	5/8 LOCK WASHER		SS
26	1	W2T118010	303-1464-1	GAUGE, OIL LEVEL		
27	1	W2T120641	841-01910	PIPE STREET ELBOW, 90°, 3/8" NPT		GALV
28	1	W2T118760	841-03490	PIPE TEE, 1-1/2" NPT		GALV
29	1	W2T120436	841-05140	PIPE NIPPLE, CLOSE, 1-1/2" NPT		GALV
30	1	W2T12229	841-00360	PIPE BUSHING, HEX, 1-1/2" x 3/8"		GALV
31	1	W2T120315	841-06340	PIPE NIPPLE, 1-1/2" NPT x 7.50		GALV
32	1	W3T18250	103-51179-1	COVER		
33	1	W2T118489	303-2151-1	BALL VALVE, 3/8" NPT		BRASS
34	1	W2T118399	303-2152-1	BALL VALVE, 1-1/2" NPT		BRASS
35	1	W2T120094	841-03141	PIPE PLUG, CSK, 2" NPT		GALV

NOTE

1. BEARING RINGS, ITEMS 4 AND 6 IN THE INTERNAL GEAR, MUST START AND STOP AT THE GEAR HALVES MATING SURFACES.

NOTES FOR NEOPRENE DRIVE SEAL INSTALLATION:

1. CLEAN DRIVE SEAL MOUNTING SURFACE OF ALL GREASE, OIL AND EXISTING OTHER FOREIGN MATERIAL. FINAL WIPE DOWN WITH ALCOHOL SWABS ON BOTH THE HOUSING AND THE NEOPRENE SEAL.
2. INSTALL NEW STOP BLOCK WITH O-RING, CAP SCREW AND LOCK WASHER.
3. APPLY 3M 94 PRIMER TO BOTH BONDING SURFACES OF THE HOUSING AND NEOPRENE SEAL AND ALLOW TO DRY.
4. APPLY ONE LAYER OF 3M VHB 4941 TAPE TO HOUSING, LEAVING THE APPLICATION TAPE ON THE OUTSIDE. USE UNIFORM PRESSURE TO INSURE COMPLETE ADHESION. CUT TAPE TO FORM A TIGHT BUTT JOINT.
5. REMOVE APPLICATION TAPE AND APPLY NEOPRENE SEAL USING UNIFORM PRESSURE. CUT SEAL TO FORM TIGHT BUTT JOINT AND BOND WITH CYANOACRYLATE ADHESIVE. LOCATE SEAL JOINT IN A PROTECTED AREA, SUCH AS UNDER THE ACCESS BRIDGE BEAM.
6. PREPARE SS BAND CLAMP AS SHOWN IN DETAIL "D"
TIP: USE ELECTRICAL TAPE (ITEM 24) TO HOLD FASTENERS ON BAND WHILE INSTALLING AROUND MAIN DRIVE HOUSING.
INSTALL THE STAINLESS STEEL BAND CLAMP, TIGHTENING THE FOUR CLAMPS IN GRADUAL STAGES UNTIL SNUG.
7. APPLY LITHIUM GREASE AT INTERSECTION OF GEAR & DRIVE SEAL.




DETAIL "C"

DETAIL "D"

4-PIECE CLAMP KIT

[illegible]

DESIGNER ELB	DATE 6/30/95
CHECKER J. Dois	DATE
ENGINEER	DATE
MANAGER	DATE
MADE FROM	
SCALE:	1:8

TITLE: TURNTABLE SUB-ASSEMBLY H40A-LT/HT DRIVES				
CUST.:				
LOC.:				
ENG.:				
 Industry Waukesha, WI 262-547-0141				
PROJECT	CODE 4002/4003	DRAWING 603-81656	SHEET 1 OF 1	REV 8

